QR2MSE 2026

The 16th International Conference on Quality, Reliability, Risk, Maintenance, and Safety Engineering

July 22-25,2026, Qingdao, Shandong, China

Sponsored by

- The Institution of Engineering and Technology
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- The Korean Reliability Society
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- European Safety and Reliability Association
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QR2MSE2026

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I. Welcome

It is our pleasure to welcome you to the 16th International Conference on Quality, Reliability, Risk, Maintenance, and Safety Engineering (QR2MSE2026). This esteemed conference will convene Qingdao, Shandong, China, from July 22 to 25, 2026.

QR2MSE2026 has been a premier international platform for experts and engineers from quality, reliability, risk, maintenance, and safety engineering to present their innovative research and share advanced methods and tools. The conference has seen substantial growth through the support of our colleagues and peers and has become one of the foremost gatherings in the reliability community all over the world. We take pride in the notable advancements in the careers of numerous young researchers who have evolved alongside this conference.

This year's conference proceedings feature 448 rigorously selected papers from approximately 900 submissions. The schedule includes 10 Keynote Lectures delivered by globally acclaimed scholars, and 180 oral presentations distributed in 11 special sessions and 14 regular sessions, offering rich opportunities for scholarly exchange and professional networking.

The success of QR2MSE2026 relies heavily on the commitment of various individuals, including conference chairs, advisory and program committee members, organizers, and volunteers. We are deeply appreciative of the support from esteemed societies and institutions such as The Institution of Engineering and Technology, Reliability Division of the Korean Society of Mechanical Engineers, The Korean Reliability Society, Reliability Engineering Association of Japan, IEEE Reliability Society Japan Joint Chapter, European Safety and Reliability Association, International Society of Engineering Asset Management, Bernoulli Society for Mathematical Statistics and Probability, Korean Society for Prognostics and Health Management, Reliability Committee of Operations Research Society of China, Reliability Engineering Institution of Chinese Mechanical Engineering Society, Center for System Reliability and Safety at the University of Electronic Science and Technology of China. Additional supporters include China University of Petroleum (East China), Qingdao University of Technology, China University of Mining and Technology, Harbin Institute of Technology, Beijing Information Science and Technology University, GRG Metrology & Test Group Co., Ltd., National Key Laboratory of Intelligent Mining Equipment Technology, Journal of Reliability Science and Engineering, Northwestern Polytechnical University, Chongqing Jiaotong University, Sichuan University of Science & Engineering, Jiangxi University of Science and Technology, Hunan University of Science and Technology, Inner Mongolia University of Technology, Chongqing University of Science and Technology, University of Shanghai for Science and Technology, Hunan Institute of Engineering, China Aero-Polytechnology Establishment, Qinda Technology Co., Ltd., Sichuan Reliability Technology Company Limited.

We are confident that QR2MSE2026 will exceed your expectations and provide a fulfilling experience. We eagerly anticipate your participation and hope you enjoy your time in Qingdao. We also look forward to continuing our collaboration at future conferences.

Hong-Zhong Huang
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IV. Keynote Speeches

A. Keynote Speech 1

Thursday, July 23 / 09:00-09:40, Howard Johnson Hall

Title: Quality Management Innovation Empowered by AI

Zhen He
Dean of the College of Management and Economics
Tianjin University, China

Abstract: With the advancement of intelligent technologies such as large language models, the Internet of Things (IoT), and sensors, artificial intelligence (AI) has entered a new stage of rapid development. AI is reshaping the paradigm of quality management, bringing both opportunities and challenges to quality science research. This report proposes a pathway for the intelligent transformation of quality management based on the application logic of digitalization, networking, platform , informatization, knowledge, and intelligence. It analyzes how AI technologies empower quality management across design quality, process quality, supply chain quality, and service quality, and presents commercial application cases. The report discusses several critical issues in the application of AI to quality management, including data quality, data integration, model trustworthiness, leadership, and change management, and identifies new research topics urgently needed for quality management in the context of intelligent manufacturing. Finally, it analyzes the relationship between quality and innovation, proposing that in the intelligent manufacturing context, the integration and convergence of quality and innovation warrant in-depth investigation at both theoretical research and industrial application levels.

Speaker Bio: **Zhen He** is a Chair Professor and Dean of the College of Management and Economics, Tianjin University. He is a Chang Jiang Scholarship Distinguished Professor of the Ministry of Education and recipient of the NSFC Distinguished Young Scientist Project. He is also an Academician of the International Academy for Quality (IAQ Academician), Fellow and Council Member of the Asia Pacific Industrial Engineering and Management Society (APIEMS). Zhen He is mainly engaged in teaching and research in the fields of quality management and quality engineering with more than 200 papers published in SCI/SSCI journals. He has led 3 key projects and 4 general projects of the National Natural Science Foundation of China, as well as 2 international cooperation projects. His research achievements have won 3 first prizes and 5 second prizes at the provincial and ministerial level. He serves as an Area Editor of the international journal ***Computers and Industrial Engineering***, and Editorial Board Member of several journals including ***International Journal of Lean Six Sigma***. He has provided quality management consulting, training, or project cooperation for more than 50 enterprises including Huawei, Midea, Haier, Baosteel, TISCO.

B. Keynote Speech 2

Thursday July 23 / 09:40-10:20, Howard Johnson Hall

Title: Data-Driven Reliability Prediction for Fuel Cell Systems

Suk Joo Bae
Director in Intelligent Bigdata Center
Department of Industrial Engineering, Hanyang University, Korea

Abstract: Fuel cells (FCs) have received much attention as potential alternatives to current battery technologies for electronic vehicles and energy storage systems in terms of their safe applications. The state-of-art FCs have had a difficulty in commercialization in terms of reliability and cost. To improve reliability of FCs, I will present degradation models for FCs under various environment conditions and reliability prediction methods through accelerated degradation testing. Reliability evaluation techniques are mainly based on statistical and AI-based degradation modeling of the FCs. New reliability issues for fuel cells are also discussed in keynote speech.

Speaker Bio: **Suk Joo Bae** is a Professor in Hanyang University, Seoul, Republic of Korea. He was a Provost in Graduate School at Hanyang University, 2021-2023. Prof. Bae received his PhD. from the ISyE Department at Georgia Tech, 2003. He was the Editor-in-Chief of Journal of the Korean Society for Quality Management, The Journal of Applied Reliability, and the Associate Editor of IEEE Transactions on Reliability, Informs Journal on Data Science. He is currently the Associate Editor in IISE Transactions DSQR Department, editorial board in ASCE-ASME Journal of Risk and Uncertainty in Engineering Systems, Part A: Civil Engineering from 2022. He is currently the President of Korea Reliability Society and he was a President, Korean Society for Prognostics and Health Management (PHM), 2023. Prof. Bae has published more than 100 journal papers including Technometrics, Journal of Quality Technology, Reliability Engineering & System Safety, IISE Transactions, and IEEE Transactions on Reliability, Mechanical Systems and Signal Processing.

C. Keynote Speech 3

Thursday, July 23 / 10:40-11:20, Howard Johnson Hall

Title: Optimal Abort Policy for Mission-Critical Systems under Imperfect Condition Monitoring

Zhisheng Ye
Department of Industrial Systems Engineering & Management
National University of Singapore

Abstract: While most on-demand mission-critical systems are engineered to be reliable to support critical tasks, occasional failures may still occur during missions. To increase system survivability, a common practice is to abort the mission before an imminent failure. We consider optimal mission abort for a system whose deterioration follows a general three-state (normal, defective, failed) semi-Markov chain. The failure is assumed self-revealed, while the healthy and defective states have to be predicted from imperfect condition monitoring data. Due to the non-Markovian process dynamics, optimal mission abort for this partially observable system is an intractable stopping problem. For a tractable solution, we introduce a novel tool of Erlang mixtures to approximate non-exponential sojourn times in the semi-Markov chain. This allows us to approximate the original process by a surrogate continuous-time Markov chain whose optimal control policy can be solved through a partially observable Markov decision process (POMDP). We show that the POMDP optimal policies converge almost surely to the optimal abort decision rules when the Erlang rate parameter diverges. This implies that the expected cost by adopting the POMDP solution converges to the optimal expected cost. Next, we provide comprehensive structural results on the optimal policy of the surrogate POMDP. Based on the results, we develop a modified point-based value iteration algorithm to numerically solve the surrogate POMDP. We further consider mission abort in a multi-task setting where a system executes several tasks consecutively before a thorough inspection. Through a case study on an unmanned aerial vehicle, we demonstrate the capability of real-time implementation of our model, even when the condition-monitoring signals are generated with high frequency.

Speaker Bio: **Zhisheng Ye** received a joint B.E. in Material Science & Engineering, and Economics from Tsinghua University. He received a Ph.D. degree from National University of Singapore. He is currently a Professor and Dean's Chair in the Department of Industrial Systems Engineering & Management at National University of Singapore. His research interests include industrial statistics, reliability engineering, and data-driven operations management. His work has been published in flagship journals in statistics, reliability, and operations management, including Bernoulli, Biometrics, Biometrika, JASA, JMLR, JRSS-B, JRSS-C, Technometrics, JQT, IEEE Trans, IJOC, IISE Trans, MSOM, OR, and POMS.

D. Keynote Speech 4

Thursday, July 23 / 11:20-12:00, Howard Johnson Hall

Title: Predictive Maintenance Optimization Considering Dependency and Monitoring Strategies

Zhigang Tian
Department of Mechanical Engineering
University of Alberta, Canada

Abstract: By utilizing condition monitoring and prediction information, predictive maintenance optimization aims to optimize maintenance and inspection activities to reduce costs, prevent failures and extend asset lives. This talk presents predictive maintenance optimization methods considering economic dependency among components, as well as component criticality. Prognostic information is modeled given that not all components are continuously monitored. Simulation based cost evaluation methods are introduced. Applications to manufacturing systems and wind power systems are presented.

Speaker Bio: **Zhigang Tian** is a professor in the Department of Mechanical Engineering at the University of Alberta, Canada. He received B.Sc. and MSc. degrees from Dalian University of Technology, China, in 2000 and 2003, respectively, and Ph.D. degree from the University of Alberta in 2007. His research is focused on predictive maintenance, reliability, asset management, wind energy, pipeline integrity, etc. He is Fellow of the International Society of Engineering Asset Management (ISEAM).

E. Keynote Speech 5

Friday, July 24 / 08:30-09:00, Howard Johnson Hall

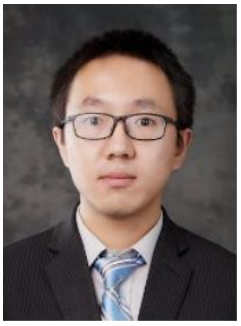
Title: Big Data Analytics for Energy Pipeline Integrity Management: Advances, Challenges, and Future Directions

Tieling Zhang
University of Wollongong, Australia

Abstract: Oil and gas pipelines are critical energy infrastructure, making Pipeline Integrity Management (PIMS) essential for safety and reliability. The accumulation of massive operational data has enabled big data analytics, driving a crucial shift in PIMS from reactive maintenance to proactive, data-driven condition prediction. This invited talk provides a comprehensive overview of big data analytics applied to energy pipeline integrity management. Core highlights include: (1) Techniques & Methods: Exploring data collection, management, and modeling strategies for pipeline condition assessment and operational decision-making; and (2) Core Innovation: Proposing a novel conceptual framework for the systematic adoption of big data analytics within the oil and gas pipeline industry. Ultimately, the integration of big data into PIMS represents a transformative approach, revolutionizing advanced monitoring, predictive maintenance, and risk management in the energy sector.

Speaker Bio: **Tieling Zhang** is the Director of the Engineering Asset Management and Systems Engineering Research Group at the University of Wollongong. Having earned his PhD from the Tokyo University of Marine Science and Technology in 2001, he possesses extensive academic and industrial expertise in reliability engineering, fault diagnosis, and health prognostics. A prolific scholar, Dr. Zhang has authored over 130 peer-reviewed papers and two books, and holds six granted international patents. He serves as an academic editor for three international journals and has led multiple special issues for Web of Science-indexed journals. Demonstrating strong project leadership, he has secured over AUD 7.0 million across more than 15 major government and industry projects spanning wind energy, railways, and pipelines. He is also the recipient of three international Best Paper awards and a Vestas IPR award. His current research leverages machine learning and big data analytics, focusing on: (1) fault diagnostics for wind turbines; (2) deep learning-based battery health management; (3) hydrogen transportation risk assessment; and (4) energy pipeline condition prediction.

F. Keynote Speech 6



Friday, July 24 / 09:00-09:30, Howard Johnson Hall

Title: Emerging AI Methods for Reliability-Based Design Optimization: From Surrogate Modeling to Intelligent Design

Zequn Wang
Associate Dean of School of Mechanical and Electrical Engineering
University of Electronic Science and Technology of China

Abstract: Reliability-Based Design Optimization (RBDO) plays a central role in engineering design by seeking optimal solutions while explicitly accounting for uncertainty, variability, and failure risk. Despite its importance, conventional RBDO remains computationally demanding because it often requires repeated reliability assessments coupled with high-fidelity simulations. Recent progress in artificial intelligence, particularly in machine learning and deep learning, is opening new possibilities for overcoming these limitations and enabling faster, more scalable, and more adaptive design strategies. This talk introduces emerging AI methods for RBDO, with a focus on surrogate modeling, active learning, uncertainty quantification, and generative design exploration. It will highlight how advanced models such as Gaussian process regression, deep neural networks, physics-informed learning approaches, and multi-fidelity frameworks can improve computational efficiency while preserving accuracy in complex and high-dimensional problems. Selected examples from engineering design will be used to demonstrate how these methods support more reliable and intelligent decision-making. The talk will also explore future trends in the field, including hybrid physics-AI methods, LLMs, generative design, and autonomous optimization workflows. The presentation aims to provide a forward-looking perspective on how AI is reshaping RBDO from surrogate-assisted analysis toward intelligent design systems.

Speaker Bio: **Zequn Wang** is a Professor of Mechanical Engineering and Associate Dean at the University of Electronic Science and Technology of China (UESTC). Before joining UESTC, he was an Assistant Professor in the Department of Mechanical Engineering–Engineering Mechanics at Michigan Technological University and a Postdoctoral Research Fellow in the Department of Mechanical Engineering at Northwestern University. Dr. Wang received his B.E. in 2006 and M.S. in 2009, both in Mechanical Engineering, from the University of Science and Technology Beijing, China. He earned his Ph.D. in Industrial Engineering from Wichita State University in 2014. Dr. Wang's research focuses on developing advanced machine learning and deep learning methods for reliability-based design under uncertainty, as well as failure diagnostics and prognostics for safety-critical engineered systems. He serves as Review Editor for the ***Journal of Structural and Multidisciplinary Optimization*** and as Associate Editor for ASME VVUQ. He was a recipient of the Overseas Excellent Young Scholars award in 2023. He is also a member of the Institute of Industrial Engineers (IIE), the American Society of Mechanical Engineers (ASME), and the American Institute of Aeronautics and Astronautics (AIAA).

G. Keynote Speech 7

Friday, July 24 / 09:30-10:00, Howard Johnson Hall

Title: The Evolving Paradigm of Reliability Engineering for Complex Systems: A Review from an Uncertainty Control Perspective

Zhaoyang Zeng
Chief Technology Officer (CTO)
China Aero-Polytechnology Establishment, Beijing, China

Abstract: Traditional reliability engineering is facing a fundamental crisis as aerospace systems transition toward software-intensive and autonomous architectures. This paper reviews the historical evolution of reliability through three distinct stages: the Statistical, Physics-of-Failure, and Prognostics Eras. It argues that these failure-centric frameworks are inadequate for managing the "unknown unknowns" and epistemic uncertainties inherent in modern complex systems. To address this gap, the study advocates for a paradigm shift toward the Resilience Era. Grounded in Safety-II principles, this new approach redefines the objective from minimizing failure rates to ensuring system survival under unforeseen perturbations. By transitioning from passive Uncertainty Quantification (UQ) to active Uncertainty Control (UC), the paper proposes architectural strategies such as System-Theoretic Process Analysis (STPA) and Run-Time Assurance (RTA). Finally, it defines the role of the System Resilience Architect in designing adaptive, safety-bounded autonomous systems.

Speaker Bio: **Zhaoyang Zeng** is the CTO of China Aero-Polytechnology Establishment (CAPE). He has conducted extensive and pioneering systematic research in maintainability and supportability analysis, maintenance support decision-making, and effectiveness evaluation. His work has significantly advanced the innovation of equipment maintenance theories, management models, and digitalization, making vital contributions to the development of maintenance and effectiveness. Throughout his distinguished career, Dr. Zeng has received numerous prestigious honors, including the National Defense Science and Technology Progress Award and the Aviation Science and Technology Progress Award. He has published over 30 scientific papers, holds 10 authorized invention patents, and has authored or translated four monographs. Additionally, he has led or contributed to the development of more than 10 National Military Standards (GJB). Dr. Zeng also holds several prominent leadership roles within the defense and industrial sectors, serving as the Deputy Head of the Equipment Maintenance Management Professional Group and a member of the Equipment Maintenance Technology Professional Group under the Equipment Development Department of the Central Military Commission. Furthermore, he is a member of the Civil Aircraft Operational Support Professional Group of the Ministry of Industry and Information Technology, a member of the National Industrial Foundation Expert Committee.

H. Keynote Speech 8

Friday, July 24 / 10:20-10:50, Howard Johnson Hall

Title: From Reliability to Responsibility: Safeguarding Humanity in the Age of AGI

Soon-Bok Lee
Department of Mechanical Engineering
Korea Advanced Institute of Science and Technology, Daejeon, Korea

Abstract: For decades, reliability engineering has successfully safeguarded complex systems by mitigating local, manageable failures. However, the trajectory toward artificial general intelligence (AGI) represents a fundamental paradigm shift that challenges traditional safety assumptions. As systems become increasingly autonomous and opaque, the primary threat is no longer mechanical breakdown, but value misalignment—where minor deviations can cascade into systemic, potentially irreversible consequences. This unprecedented risk demands a complete redefinition of the discipline. In the AGI era, reliability engineering must evolve: (1) from preventing failure to ensuring alignment; (2) from engineering robustness to demanding transparency; and (3) from optimizing performance to enforcing human-centered governance. Reliability must now address not just how systems fail, but whether they serve ethical principles. Ultimately, our challenge is both technical and moral: the mission is no longer merely building dependable systems, but guaranteeing that intelligent systems remain unequivocally aligned with humanity.

Speaker Bio: **Soon-Bok Lee** is Professor Emeritus of Mechanical Engineering at KAIST and a distinguished leader in reliability and safety engineering. Since earning his Ph.D. from Stanford University in 1980, he has dedicated over four decades to advancing reliability science, with expertise spanning electronic packaging, fatigue, and micro/nano-scale structures. He notably founded the Computer Aided Reliability Evaluation (CARE) Laboratory, a designated National Research Laboratory. A prolific scholar and mentor, Dr. Lee has published over 200 SCI-indexed papers and supervised more than 60 graduate students who now hold prominent roles across global industries and academia. He is a recognized community leader, having served as the founding President of the KSME Reliability Division, Vice President of the Korea Reliability Society, and Chair of the KATS Reliability Expert Committee. Globally, he has contributed to leading editorial boards, acted as General Chair for major conferences like EMAP 2001 and ICEM 2006, and served as KAIST's Ombudsperson from 2019 to 2021.

I. Keynote Speech 9

Friday, July 24 / 10:50-11:20, Howard Johnson Hall

Title: Intelligent Technology and Application for High-End Equipment Health Management

Ershun Pan
Head of Department of Industrial Engineering and Management
Shanghai Jiao Tong University, Shanghai, China

Abstract: Industrial big data serves as a crucial carrier for characterizing equipment performance evolution, operational behavior characteristics, and health status changes, and also forms the key foundation for advancing the upgrade of intelligent operation & maintenance and health management of high-end equipment. This report focuses on condition monitoring data, production operation data, and system-level multimodal data, systematically elaborating the intelligent theories, key technologies, and engineering application pathways for high-end equipment health management under the context of multi-source and multimodal information fusion. Drawing on typical scenarios such as Large Aircraft, Machine Tools, Port Equipment, and Steel Production Lines, it highlights data-driven fault diagnosis and prediction methods for equipment, intelligent operation & maintenance and control decision-making technologies that synergize production and maintenance, along with advances in large model-based health management agents, offering methodological reference and practical guidance for industrial intelligent health management.

Speaker Bio: **Ershun Pan** is Head of Department of Industrial Engineering and Management, and Executive Dean of Chinese Institute for Quality Research, Shanghai Jiao Tong University. He is also Vice Chairmen of Chinese Industrial Engineering Institute of CMES, Vice President of China Machine Building Quality Management Association, and Managing Editor of "Industrial Engineering and Management" Journal. His research interests include Reliability Engineering and Maintenance Optimization, Quality Control Theories and Methods, and Production Operation Management. Prof. Pan has published over 100 papers in SCI journals, and edited the textbooks "Production Planning and Control" and "Reliability and Maintenance Management". He has led over 40 projects, including 1 National Key Research and Development Program, and 5 general projects of the National Natural Science Foundation of China. His research and teaching achievements have earned him New Century Excellent Talents from Ministry of Education, the First Prize in Shanghai Scientific and Technological Progress, the First Prize in Quality Technology from the China Quality Association, and the First Prize in Shanghai Teaching Achievement, among others.

J. Keynote Speaker 10

Friday, July 24 / 11:20-11:50, Howard Johnson Hall

Title: Fault-tolerant control (FTC) of fully actuated systems

Donghua Zhou
Southeast University, Nanjing, China

Abstract: High-order fully actuated nonlinear systems are more suitable for controller design, because the whole structure is fully parameterized, and the nonlinearity can be decoupled. However, system faults may disrupt the nonlinear cancellation principle of fully actuated systems, thus fault -tolerant control (FTC) of high-order fully actuated systems need to be studied, which is a key technology to improve the safety and reliability of complex systems. This report gives the latest progress of my group on the FTC of high-order fully actuated systems, including both deterministic and stochastic systems.

Speaker Bio: **Donghua Zhou** (Fellow, IEEE) received the B.Eng., M.Sc., and Ph.D. degrees in electrical engineering from Shanghai Jiao Tong University, Shanghai, China, in 1985, 1988, and 1990, respectively. He was an Alexander von Humboldt Research Fellow with the University of Duisburg, Duisburg, Germany, from 1995 to 1996, and a Visiting Scholar with Yale University, New Haven, CT, USA, from 2001 to 2002. He joined Tsinghua University, Beijing, China, in 1996, where he was promoted to Full Professor in 1997 and was the Head of the Department of Automation from 2008 to 2015. He is currently a Professor with Southeast University, Nanjing, China, and a Joint Professor with Shandong University of Science and Technology, Qingdao, China. He has authored or co-authored over 230 peer-reviewed international journal articles and nine monographs in the areas of fault diagnosis, fault-tolerant control, and operational safety evaluation. Dr. Zhou is a member of IFAC TC on SAFEPROCESS and a fellow of IET and the Chinese Association of Automation (CAA). He was the NOC Chair for the 6th IFAC Symposium on SAFEPROCESS 2006. He is an Associate Editor of the Journal of Process Control, the Vice Chair for CAA, and the TC Chair for the SAFEPROCESS Committee, CAA.

V. Program Information

A. Conference Topics

I **Reliability Modeling and Risk Analysis**

II **Reliability, Maintainability, and Supportability**

III **System Analysis, Simulation and Optimization**

IV **Fault Diagnosis, Prognosis, Condition Monitoring and PHM**

V **Robust Design, Reliability-Based Design, and Lifecycle Design**

VI **Maintenance and Warranty Management**

VII **Failure Physics, Material Science, Data Analysis, and Reliability Testing**

B. Program at A Glance

<table>
<tr><th>Date
Time</th><th>July 22
(Wednesday)</th><th>July 23
(Thursday)</th><th>July 24
(Friday)</th><th>July 25
(Saturday)</th></tr>
<tr><td rowspan="6">08:30-12:00</td><td rowspan="7"></td><td>Opening Ceremony</td><td>Keynote Speech 5</td><td rowspan="6">Session E</td></tr>
<tr><td>Keynote Speech 1</td><td>Keynote Speech 6</td></tr>
<tr><td>Keynote Speech 2</td><td>Keynote Speech 7</td></tr>
<tr><td>Tea Break</td><td>Tea Break</td></tr>
<tr><td rowspan="2">Keynote Speech 3</td><td>Keynote Speech 8</td></tr>
<tr><td rowspan="2">Keynote Speech 9</td></tr>
<tr><td rowspan="2">Keynote Speech 4</td><td>Keynote Speech 10</td></tr>
<tr><td>12:00-14:00</td><td>Lunch</td><td>Lunch</td><td>Lunch</td></tr>
<tr><td rowspan="3">14:00-18:30</td><td rowspan="3">Registration</td><td>Session A</td><td>Session C</td><td rowspan="3"></td></tr>
<tr><td>Tea Break</td><td>Tea Break</td></tr>
<tr><td>Session B</td><td>Session D</td></tr>
<tr><td>18:30</td><td>Dinner</td><td>Dinner</td><td>Banquet</td><td></td></tr>
</table>

C. Detailed Timetable

July 23 [Thursday] 8:30-12:00

Time \ Room	Howard Johnson Hall	
08:30-09:00	**Opening Ceremony**	
09:00-09:40	**Chair:** Loon Ching Tang National University of Singapore, Singapore	**Keynote Speech 1:** Zhen He Dean of the College of Management and Economics Tianjin University, China **Quality Management Innovation Empowered by AI**
09:40-10:20	**Chair:** Yu Liu University of Electronic Science and Technology of China, China	**Keynote Speech 2:** Suk Joo Bae Director in Intelligent Bigdata Center Department of Industrial Engineering, Hanyang University, Korea **Data-Driven Reliability Prediction for Fuel Cell Systems**
10:20-10:40	***Tea Break***	
10:40-11:20	**Chair:** Nam-Su Huh Seoul National University of Science and Technology, Korea	**Keynote Speech 3:** Zhisheng Ye Department of Industrial Systems Engineering & Management National University of Singapore **Optimal Abort Policy for Mission-Critical Systems under Imperfect Condition Monitoring**
11:20-12:00	**Chair:** Lu Jin University of Electro-Communications, Japan	**Keynote Speech 4:** Zhigang Tian Department of Mechanical Engineering University of Alberta, Canada **Predictive Maintenance Optimization Considering Dependency and Monitoring Strategies**
12:00-14:00	***Lunch***	

July 23 [Thursday] 14:00-16:00

Time \ Room		Multifunctional Hall 1	Multifunctional Hall 2	Multifunctional Hall 3	Multifunctional Hall 4	Multifunctional Hall 5
Conference Topic		Reliability Modeling and Risk Analysis	The Korean Engineers' Reliability Activities	AI-Enhanced Safety and Reliability Assurance for Nuclear Installations	Fault Diagnosis, Prognosis, Condition Monitoring and PHM	Data-driven Reliability Analysis for In-service Infrastructures
Special Session A	**14:00-14:15**	QR2MSE2026 01-1007	QR2MSE2026 026-0003	QR2MSE2026 019-1001	QR2MSE2026 04-1021	QR2MSE2026 03-0008
	14:15-14:30	QR2MSE2026 01-1006	QR2MSE2026 026-0002	QR2MSE2026 019-1002	QR2MSE2026 04-0026	QR2MSE2026 03-0038
	14:30-14:45	QR2MSE2026 01-0016	QR2MSE2026 025-0001	QR2MSE2026 019-1006	QR2MSE2026 04-0038	QR2MSE2026 03-1019
	14:45-15:00	QR2MSE2026 04-1028	QR2MSE2026 025-0005	QR2MSE2026 019-0004	QR2MSE2026 04-0041	QR2MSE2026 03-1018
	15:00-15:15	QR2MSE2026 01-0053	QR2MSE2026 025-0003	QR2MSE2026 019-1016	QR2MSE2026 04-1005	QR2MSE2026 03-0005
	15:15-15:30	QR2MSE2026 01-0047	QR2MSE2026 025-0004	QR2MSE2026 019-1013	QR2MSE2026 04-1006	QR2MSE2026 08-0001
	15:30-15:45	QR2MSE2026 01-1005	QR2MSE2026 026-0001	QR2MSE2026 019-1014	QR2MSE2026 08-1009	QR2MSE2026 08-1011
	15:45-16:00	QR2MSE2026 01-1017	QR2MSE2026 04-0006	QR2MSE2026 01-0032	QR2MSE2026 04-0004	QR2MSE2026 08-1013
16:00-16:30		***Tea Break***				

July 23 [Thursday] 16:30-18:30

Time \ Room		Multifunctional Hall 1	Multifunctional Hall 2	Multifunctional Hall 3	Multifunctional Hall 4	Multifunctional Hall 5
Conference Topic		Reliability Modeling and Risk Analysis	Korean Reliability Society Activities on Warranty and Maintenance	AI-Enhanced Safety and Reliability Assurance for Nuclear Installations	Fault Diagnosis, Prognosis, Condition Monitoring and PHM	Reliability and Safety of Coastal and Offshore Infrastructures
Special Session B	**16:30-16:45**	QR2MSE2026-01-1022	QR2MSE2026-08-1006	QR2MSE2026-019-1012	QR2MSE2026-04-1024	QR2MSE2026-01-0039
	16:45-17:00	QR2MSE2026-08-0003	QR2MSE2026-027-1001	QR2MSE2026-06-0006	QR2MSE2026-08-1016	QR2MSE2026-01-0040
	17:00-17:15	QR2MSE2026-08-1014	QR2MSE2026-027-1002	QR2MSE2026-08-0002	QR2MSE2026-04-1022	QR2MSE2026-017-0005
	17:15-17:30	QR2MSE2026-01-1049	QR2MSE2026-025-0006	QR2MSE2026-08-1004	QR2MSE2026-04-0028	QR2MSE2026-017-0003
	17:30-17:45	QR2MSE2026-01-0003		QR2MSE2026-019-1007	QR2MSE2026-08-1002	QR2MSE2026-017-0007
	17:45-18:00	QR2MSE2026-01-0038		QR2MSE2026-06-1007	QR2MSE2026-08-1007	QR2MSE2026-01-1019
	18:00-18:15	QR2MSE2026-08-1012		QR2MSE2026-06-1001	QR2MSE2026-04-1010	QR2MSE2026-01-1036
	18:15-18:30	QR2MSE2026-01-0052		QR2MSE2026-06-0008	QR2MSE2026-04-0022	QR2MSE2026-01-0017
18:30		***Dinner***				

July 24 [Friday] 08:30-12:00

Time \ Room	Howard Johnson Hall	
08:30-09:00	**Chair:** Bao-Ping Cai China University of Petroleum, China	**Keynote Speech 5:** Tieling Zhang University of Wollongong, Australia **Big Data Analytics for Energy Pipeline Integrity Management: Advances, Challenges, and Future Directions**
09:00-09:30	**Chair:** Jae-Hak Lim Hanbat National University, Korea	**Keynote Speech 6:** Zequn Wang University of Electronic Science and Technology of China **Emerging AI Methods for Reliability-Based Design Optimization: From Surrogate Modeling to Intelligent Design**
09:30-10:00	**Chair:** Shichang Du Shanghai Jiao Tong University, China	**Keynote Speech 7:** Zhaoyang Zeng China Aero-Polytechnology Establishment, Beijing, China **The Evolving Paradigm of Reliability Engineering for Complex Systems: A Review from an Uncertainty Control Perspective**
10:00-10:20	***Tea Break***	
10:20-10:50	**Chair:** Peng Su Beijing Information Science and Technology University, China	**Keynote Speech 8:** Soon-Bok Lee Korea Advanced Institute of Science and Technology, Daejeon, Korea **From Reliability to Responsibility: Safeguarding Humanity in the Age of AGI**
10:50-11:20	**Chair:** Baisong Pan Zhejiang University of Technology, China	**Keynote Speech 9:** Ershun Pan Shanghai Jiao Tong University, Shanghai, China **Intelligent Technology and Application for High-End Equipment Health Management**
11:20-11:50	**Chair:** Shuguang He Tianjin University, China	**Keynote Speech 10:** Donghua Zhou Southeast University, Nanjing, China **Fault-tolerant control (FTC) of fully actuated systems**
12:00-14:00	***Lunch***	

July 24 [Friday] 14:00-16:00

Time \ Room		Multifunctional Hall 1	Multifunctional Hall 2	Multifunctional Hall 3	Multifunctional Hall 4	Multifunctional Hall 5
Conference Topic		Robust, Reliability-Based, and Lifecycle Design	Physics-Informed AI for Reliability Engineering and Intelligent Maintenance	Reliability Modeling and Risk Analysis	Fault Diagnosis, Prognosis, Condition Monitoring and PHM	Failure Physics, Material Science, Data Analysis, and Reliability Testing
Special Session C	**14:00-14:15**	QR2MSE2026 05-0007	QR2MSE2026 023-0006	QR2MSE2026 01-1029	QR2MSE2026 04-1007	QR2MSE2026 07-1017
	14:15-14:30	QR2MSE2026 05-1008	QR2MSE2026 023-0004	QR2MSE2026 01-0008	QR2MSE2026 04-1027	QR2MSE2026 019-1008
	14:30-14:45	QR2MSE2026 05-0004	QR2MSE2026 023-0007	QR2MSE2026 01-0034	QR2MSE2026 04-0014	QR2MSE2026 07-0015
	14:45-15:00	QR2MSE2026 05-0008	QR2MSE2026 023-0008	QR2MSE2026 01-1034	QR2MSE2026 04-0015	QR2MSE2026 07-1002
	15:00-15:15	QR2MSE2026 05-1011	QR2MSE2026 023-0003	QR2MSE2026 01-0014	QR2MSE2026 04-0017	QR2MSE2026 07-1019
	15:15-15:30	QR2MSE2026 01-0030	QR2MSE2026 023-1001	QR2MSE2026 01-0051	QR2MSE2026 04-1026	QR2MSE2026 07-1021
	15:30-15:45	QR2MSE2026 01-0045	QR2MSE2026 019-1005	QR2MSE2026 01-0036	QR2MSE2026 04-1017	QR2MSE2026 07-1022
	15:45-16:00	QR2MSE2026 01-1045	QR2MSE2026 04-0003	QR2MSE2026 01-1021	QR2MSE2026 04-1009	QR2MSE2026 01-0048
16:00-16:30		***Tea Break***				

July 24 [Friday] 16:30-18:00

Time \ Room		Multifunctional Hall 1	Multifunctional Hall 2	Multifunctional Hall 3	Multifunctional Hall 4	Multifunctional Hall 5
Conference Topic		Reliability-centric Lifecycle Management for Marine and Offshore Assets	Data-driven Reliability Analysis for In-service Infrastructures	Synergistic AI and Advanced Modeling for Quality, Reliability, Maintainability, and PHM: Integration and Aggregation	Fault Diagnosis, Prognosis, Condition Monitoring and PHM	Failure Physics, Material Science, Data Analysis, and Reliability Testing
Special Session D	**16:30-16:45**	QR2MSE2026 04-1038	QR2MSE2026 022-0003	QR2MSE2026 024-1002	QR2MSE2026 04-0027	QR2MSE2026 07-0007
	16:45-17:00	QR2MSE2026 021-1003	QR2MSE2026 022-0005	QR2MSE2026 03-0031	QR2MSE2026 04-0031	QR2MSE2026 07-0009
	17:00-17:15	QR2MSE2026 021-1004	QR2MSE2026 01-1025	QR2MSE2026 03-0037	QR2MSE2026 04-0036	QR2MSE2026 07-1003
	17:15-17:30	QR2MSE2026 02-0007	QR2MSE2026 01-0050	QR2MSE2026 03-0032	QR2MSE2026 04-0040	QR2MSE2026 07-1006
	17:30-17:45	—	—	QR2MSE2026 03-1016	QR2MSE2026 04-1008	QR2MSE2026 07-1012
	17:45-18:00	—	—	QR2MSE2026 01-0031	QR2MSE2026 04-1032	QR2MSE2026 07-1023
	18:00-18:15	—	—	QR2MSE2026 03-0002	—	—
	18:15-18:30	—	—	—	—	—
18:30		***Banquet***				

July 25 [Saturday] 08:30-10:30

Time \ Room		Multifunctional Hall 1	Multifunctional Hall 2	Multifunctional Hall 3	Multifunctional Hall 4	Multifunctional Hall 5
Conference Topic		Reliability, Maintainability, and Supportability	System Analysis, Simulation and Optimization	Fault Diagnosis, Prognosis, Condition Monitoring and PHM	Reliability Modeling and Risk Analysis	Advanced Reliability and Safety Assessment of Marine and Offshore Structures
Special Session E	**08:30-08:45**	QR2MSE2026-03-1007	QR2MSE2026-03-1003	QR2MSE2026-04-0012	QR2MSE2026-08-1008	QR2MSE2026-01-0033
	08:45-09:00	QR2MSE2026-04-1030	QR2MSE2026-03-0018	QR2MSE2026-05-1004	QR2MSE2026-08-1005	QR2MSE2026-018-0002
	09:00-09:15	QR2MSE2026-02-1001	QR2MSE2026-03-0026	QR2MSE2026-04-0037	QR2MSE2026-08-1010	QR2MSE2026-03-0010
	09:15-09:30	QR2MSE2026-02-0006	QR2MSE2026-03-0028	QR2MSE2026-08-1015	QR2MSE2026-01-0057	QR2MSE2026-03-0035
	09:30-09:45	QR2MSE2026-02-1005	QR2MSE2026-03-0012	QR2MSE2026-04-1015	QR2MSE2026-01-0055	QR2MSE2026-06-1008
	09:45-10:00	QR2MSE2026-03-0001	QR2MSE2026-03-1024	QR2MSE2026-04-0025	QR2MSE2026-06-0002	QR2MSE2026-01-0049
	10:00-10:15	QR2MSE2026-017-0006	QR2MSE2026-017-0002	QR2MSE2026-04-0043	QR2MSE2026-06-0003	QR2MSE2026-04-0047
	10:15-10:30	QR2MSE2026-01-1047		QR2MSE2026-04-1039		
12：00		***lunch***				

VI. Technical Program

July 23 [Thursday] Session A in Multifunctional Hall 1

14:00-16:00 **Reliability Modeling and Risk Analysis**

Moderators: Renyan Jiang, Wenzhou University, China
Xinliang Dai, University of Electronic Science and Technology of China,China

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14:00-14:15 QR2MSE2026-01-1007 A Modified Risk Priority Number and Its Thresholds / ***Renyan Jiang*** *(Wenzhou University), Jiawei Xiang, Jianhong Yu*

Summary: Addressing traditional FMEA limitations, this paper modifies the Risk Priority Number into a weighted geometric mean cube using AHP, defining statistically grounded thresholds to provide a simpler, more accurate risk assessment.

14:15-14:30 QR2MSE2026-01-1006 Research on FPGA Fault Mode Analysis under Complex Space Environments and Risk Prevention & Control in Aerospace Applications / ***Jiaxing Leng*** *(Innovation Academy for Microsatellites, CAS), Zongsheng Xie, Tong Liu, Zhichao Chen*

Summary: Targeting complex space radiation environments, this paper constructs an end-to-end multi-mechanism risk control framework for FPGAs, integrating device-level, single-unit-level, and satellite-level mitigation strategies to ensure long-life aerospace mission reliability.

14:30-14:45 QR2MSE2026-01-0016 Generative Poly-Morphic Reliability (GPMR) Modelling Method For Mosa And Software-Defined Systems / ***Wensheng Peng*** *(China Aero-Polytechnology Establishment), Zhaoyang Zeng, Junran Wang, Cong Lin, Jinyue Li*

Summary: Targeting complex space radiation environments, this paper constructs an end-to-end multi-mechanism risk control framework for FPGAs, integrating device-level, single-unit-level, and satellite-level mitigation strategies to ensure long-life aerospace mission reliability.

14:45-15:00 QR2MSE2026-04-1028 Interpretable Characterization of Running-In Behavior in Nuclear-Grade Motor-Operated Valves under Combined Stress Testing / ***Lin Zhang*** *(Nuclear Power Institute of China), Suting Zhou, Junming Wen, Limiao Xing, Wenbing Tang*

Summary: An interpretable multivariate trend indicator characterizes running-in behavior of nuclear-grade motor-operated valves under combined stress testing with limited failure labels.

15:00-15:15 QR2MSE2026-01-0053 Optimizing Phase-Dependent Protection and Resource Allocation for Phased-Mission Systems under Internal Failures and Intentional / ***Chen Lin*** *(Xinyang Agriculture and Forestry University), Zhenggeng Ye*

Summary: This paper models phased-mission systems subjected to random internal failures and strategic external attacks, formulating an optimization problem to dynamically allocate phase-dependent protection resources and maximize closed-form system reliability.

15:15-15:30 QR2MSE2026-01-0047 An Adaptive Step Size Adjustment Method for Reliability-Based Design Optimization / ***Xue An*** *(Yanbian University), Zhiwei Hu, De Li, Jiaming Li*

Summary: To enhance the efficiency of reliability-based design optimization, this paper proposes an adaptive step size adjustment method that dynamically updates search regions using gradient information, significantly reducing computation time.

15:30-15:45 QR2MSE2026-01-1005 Modeling and Analysis of Quality Risk Management Requirements for Equipment Test Facilities Under High-Quality and Efficient Assurance Tasks / ***Jun Yang*** *(National University of Defense Technology), Xiaoxiong Zhang, Xiang Jia, Fangxiao Wang, Hao Yan*

Summary: Mapping task-level indicators into actionable capability requirements, this paper proposes a T-Q-R-C-D model to manage quality risks in test equipment and facilities, successfully verifying its effectiveness in improving task assurance.

15:45-16:00 QR2MSE2026-01-1017 Mining Emergent Failure Paths from Aviation Accident Reports Using STAMP-Based LLM Extraction and Semantic Graph Retrieval / ***Shumao Qiu*** *(China Aero-Polytechnology Establishment), Wensheng Peng, Changdong Zheng, Yu Hao*

Summary: To systematically uncover emergent failure mechanisms, this study proposes a data-driven STPA framework that integrates large language models and semantic graph retrieval to extract structural fault propagation paths from historical aviation narratives.

16:00 Tea Break

July 23 [Thursday] Session A in Multifunctional Hall 2

14:00-16:00	**The Korean Engineers' Reliability Activities**
Moderators:	Nam-Su Huh, Seoul National University of Science and Technology, Korea Jongseong Brad Choi, The State University of New York, Korea

14:00-14:15 QR2MSE2026-026-0003 Micro-Splatting for Physical Ai: High-Fidelity Neural Rendering, Digital Twins, and Applications to Automated Inspection of Nucl / ***Jongseong Brad Choi*** *(State University of New York), Do-Young Ko, Dongsoo Kang, Jongmoon Park, Sang Hyuk Lee*

Summary: To bridge the Sim2Real gap, this seminar introduces Micro-Splatting, a neural rendering approach that preserves high-frequency structural details in industrial environments for reliable Physical AI validation.

14:15-14:30 QR2MSE2026-026-0002 On the Training Data Sizing for the ANN Inverse Kinematics Solutions / ***Dong-Won Lim*** *(The University of Suwon)*

Summary: Applying statistical learning principles, this research investigates the critical relationship between training sample size and model accuracy in ANN-based inverse kinematics to optimize computational efficiency in robotics.

14:30-14:45 QR2MSE2026-025-0001 Development of Thermo-Fluid Prediction Methodologies for Improving Thermal Reliability of Cooling Passages in Afpm Motors / ***Sungjin Yang*** *(Korea Electronics Technology Institute)*, *Jongrak Choi, Yongwoo Shin, Heemoon Kang*

Summary: Addressing stringent maritime emission regulations, this paper highlights axial flux permanent magnet motors as highly efficient, power-dense alternatives to radial motors for the core power sources of electric propulsion vessels.

14:45-15:00 QR2MSE2026-025-0005 Numerical Investigation of Smoke Control Characteristics under Emergency Ventilation Conditions in Railway Platform Fires / ***Jongrak Choi*** *(Korea Electronics Technology Institute), Sungjin Yang, Yongwoo Shin, Seungmin Guk*

Summary: This paper quantitatively evaluates how ventilation conditions impact smoke spread, toxic gas discharge, and visibility during deep underground railway fires, providing critical insights for optimizing early-stage exhaust and passenger evacuation safety.

15:00-15:15 QR2MSE2026-025-0003 Plastic Collapse Analysis of Flawed Pipe-To-Elbow Welds under Combined Internal Pressure and In-Plane Bending / ***Seong-Su Kim*** *(Seoul National University of Science and Technology), Nam-Su Huh*

Summary: Highlighting the non-conservatism of traditional straight-pipe limit load estimations, this research focuses on capturing large-strain cross-sectional ovalization to accurately assess the structural integrity of flawed pipe-to-elbow welds in nuclear systems.

15:15-15:30 QR2MSE2026-025-0004 Impact Assessment of ISI Interval and Pod Characteristics on Nuclear Piping Rupture Frequency / ***Seok-Jun Yoon*** *(Seoul National University of Science and Technology), Jong-Sung Kim, Nam-Su Huh*

Summary: This study addresses the structural integrity of nuclear piping systems by evaluating how in-service inspection performance and intervals quantitatively influence rupture frequency, providing essential data to support future inspection optimization.

15:30-15:45 QR2MSE2026-026-0001 Numerical Analysis of Annular 3-Omega Heater Design for Anisotropic Thermal Conductivity Measurement / ***Junyoung Park*** *(Hanyang University), Doheon Koo, Mugyeom Jung, Sangyeun Park, Hye Seok Na, Wondo Kim, Hyun Sung Park, Hongyun So*

Summary: This study proposes a practical annular-heater 3-omega method requiring only a single AC source to independently and accurately decouple anisotropic thermal conductivities in advanced materials.

15:45-16:00 QR2MSE2026-04-0006 Development of An Equipment Remaining Useful Life Prediction Model Based on Bayesian Lstm and Physics-Informed Constraints / ***Jong Woon Kim*** *(Nemoys Co.), Min Kim, Young Seon Kim, Yun Kyung Park*

Summary: To eliminate physically impossible degradation predictions and quantify uncertainty, this study develops a Physics-Informed Bayesian LSTM framework that enforces monotonic health index constraints via targeted loss penalties.

16:00 Tea Break

July 23 [Thursday] Session A in Multifunctional Hall 3

14:00-16:00 **AI-Enhanced Safety and Reliability Assurance for Nuclear Installations**

Moderators: Jun Yang, South China University of Technology, China
Guohua Wu, Shenzhen Technology University, China
Bing Zhang, State Key Laboratory of Nuclear Power Safety Monitoring Technology and Equipment, China
Zhihui Xu, State Key Laboratory of Nuclear Power Safety Monitoring Technology and Equipment, China
Ming Yang, Shenzhen University, China
Hidekazu Yoshikawa, Kyoto University, Japan
Takeshi Matsuoka, Utsunomiya University, Japan

14:00-14:15 QR2MSE2026-019-1001 Availability Analysis Considering Component Degradation and Imperfect Repair Actions / ***Takeshi Matsoka*** *(Utsunomiya University), Hidekazu Yoshikaw, Junya Nitt, Masataka Abe, Jun Yang*

Summary: By extending the GO-FLOW methodology, this study enhances system availability analysis by integrating component degradation, imperfect repair conditions, and expert judgment, demonstrated on an Auxiliary Feedwater System.

14:15-14:30 QR2MSE2026-019-1002 Research on Intelligent Supports for Emergent Response at Nuclear Power Plants / ***Jun Yang*** *(South China University of Technology)*, *Hidekazu Yoshikawa, Masataka Abe, Junya Nitta, Takeshi Matsoka, Xiya Zhu*

Summary: Highlighting practical applications in pressurized water reactors, this research develops a risk-informed knowledge base and intelligent decision support system specifically for diagnosing small-break loss-of-coolant accidents.

14:30-14:45 QR2MSE2026-019-1006 A Spatio-Temporal Approach to Predicting Meteorological Fields for Radionuclide Dispersion / ***Hongxing Lu*** *(Shenzhen Technology University), Jing Zhang, Kai Ma, Guohua Wu, Wenlin Wang, Haichuan Zhang, Jiaojiao Pan, Zekai Mei, Jiahao Huang*

Summary: Addressing wind field heterogeneity, this paper introduces a hybrid temporally corrected Conv-LSTM model with regional attention, providing high-precision meteorological predictions essential for reliable nuclear emergency radionuclide dispersion modeling.

14:45-15:00 QR2MSE2026-019-0004 Research on Startup And Shutdown Sequential Control System for Nuclear Power Plant / ***Zhuangzhuang Yu*** *(China Nuclear Power Engineering Co., Ltd.), Xiao Lin, Xin Zhang*

Summary: This paper introduces a highly automated sequence control system for nuclear power unit startup and shutdown, significantly reducing human error and operator workload by digitizing cumbersome paper-based procedures.

15:00-15:15 QR2MSE2026-019-1016 Research on The Strategy of Switching from Outage To Routine Maintenance of Low-Voltage Distribution Panels in Nuclear Power Plant / ***Xiao Lin****, Zhuangzhuang Yu (China Nuclear Power Engineering Co., Ltd.), Di Yang, Xin Zhang*

Summary: Delivering significant operational safety and economic benefits, this paper proposes innovative technical transformation schemes to decouple distribution panel maintenance from downstream load power supply during continuous nuclear plant operations.

15:15-15:30 **QR2MSE2026-019-1013** A Numerical Integration Approach for Reliability Analysis of Dynamic Fault Tree / ***Yingrong Yao*** *(South China University of Technology), Jun Yang, Ming Yang*

Summary: Overcoming the state-space explosion problem in Dynamic Fault Trees, this research formulates a unified, highly accurate numerical integration approach for reliability analysis, offering computational efficiency comparable to Markov chain models.

15:30-15:45 **QR2MSE2026-019-1014** Simulation-Based Analysis of Adversarial Combat Using the Lanchester Model / ***Xiya Zhu*** *(South China University of Technology), Jiawei Ying, Haoming Ma, Jun Yang*

Summary: Utilizing the Lanchester Combat Model and Monte Carlo simulations, this study quantitatively evaluates Physical Protection System effectiveness, revealing how adversarial force ratios and attrition coefficients drive neutralization probabilities.

15:45-16:00 **QR2MSE2026-01-0032** Dynamic Reliability Modeling and Assessment of CNC Machine Tools Considering Vibration State Evolution / ***Caixia Zhang****, Tong Zhao (Beijing University of Technology), Zhong Ye, Yuanqi Liu, Xunyi Liu, Yongbo Kang, Tao Zhang*

Summary: Overcoming static model limitations, this paper proposes a dynamic reliability modeling method that integrates real-time vibration acceleration RMS degradation with a non-homogeneous Markov process to provide earlier, more accurate fault warnings.

16:00 Tea Break

July 23 [Thursday] Session A in Multifunctional Hall 4

14:00-16:00 **Fault Diagnosis, Prognosis, Condition Monitoring and PHM**

Moderators: Yanfu Wang, China University of Petroleum (East China), China
Peng Guo, Southwest Jiaotong University, China

14:00-14:15 QR2MSE2026-04-1021 DDA-CMMD Transfer Learning and Acoustic-Vibration Fusion for Planetary Gearbox Fault Diagnosis under Variable-Speed Conditions / ***Zixin Cheng*** *(Jiangxi University of Science and Technology), Zihao Zhou, Dan Liu, Yingku Gu*

Summary: This study proposes a cross-condition diagnostic framework featuring dynamic marginal and class-conditional distribution alignments.

14:15-14:30 QR2MSE2026-04-0026 A Dynamic Failure Diagnosis Approach for Hydraulic Hoists Integrating Random Forest and Fault Tree Analysis / ***Yesen Zhu****, Jie Fu, Shihai Yang, Yiwei Geng, Zan Gao, Xingwei Zhen (Dalian University of Technology)*

Summary: This paper proposes a data-driven framework combining Random Forests and Fault Tree Analysis to accurately identify failure modes and trace root causes in complex hydraulic hoists.

14:30-14:45 QR2MSE2026-04-0038 Attribute Feature Decoupling Learning For Domain Generalization Fault Diagnosis In High-Speed Train Bogies / ***Weiwang Lv****, Kai Wang, Zuoyi Chen (University of Electronic Science and Technology of China), Huaming Qian, Hong-Zhong Huang*

Summary: This paper proposes a deep decoupling network that explicitly separates operating condition features from fault-intrinsic attributes, delivering highly generalizable intelligent fault diagnosis for high-speed train bogies across unseen conditions.

14:45-15:00 QR2MSE2026-04-0041 MSCNFormer: A Parallel Hierarchical Fusion Network for Weak-Signal TBM Main-Bearing Diagnosis Under Limited Samples / ***Peng Guo*** *(Southwest Jiaotong University), Yitao Wang, Shuang Gao, Zhiyao Zhang, Chonghe Zang*

Summary: This paper proposes MSCNFormer, a hierarchical network fusing multi-scale convolution and variance-guided sparse attention, to successfully detect weak, low-speed fault signals in tunnel boring machines using strictly limited samples.

15:00-15:15 QR2MSE2026-04-1005 Gated Recurrent Unit Network and Wiener Process Model-Based Fusion Framework for Degradation Modeling of Lithium Battery / ***Xiaowu Chen*** *(University of Electronic Science and Technology of China), Jiulong Tang, Zhen Liu*

Summary: Integrating Savitzky-Golay filtering with GRU networks and Wiener processes, this hybrid framework accurately fits complex battery degradation trends while robustly quantifying predictive uncertainty for reliable industrial electronic maintenance.

15:15-15:30 QR2MSE2026-04-1006 Optimization and Application of Dowhhole Throttling Technology for High-Pressure Gas Wells in Tongnan Gas Field / ***Xuan Fu*** *(China University of Petroleum-Beijing at Karamay), Wenhang Chen, Wei Wang, Qiushi Gu, Xiaokai Xing*

Summary: This paper optimizes two-stage downhole throttling technology using a reservoir-wellbore coupling model, effectively eliminating hydrate ice blockages and ensuring the safe, efficient development of high-pressure gas wells.

15:30-15:45 QR2MSE2026-08-1009 Joint Optimization of Condition-based Maintenance and Spare Parts Ordering Considering Refurbishment / ***Xia Tang*** *(Southwestern University of Finance and Economics), Hui Xiao*

Summary: Overcoming the limitations of conventional image correlation, this paper proposes BladeNet, a customized convolutional neural network capable of highly accurate, sub-pixel surface displacement monitoring for wind turbine blade deformation.

15:45-16:00 QR2MSE2026-04-0004 Digital Twin Modelling and Update for Industrial Robotic Arms based on Uncertain Parameter Evolution / ***Wencai Liao*** *(Chongqing University), Bin Wang, Yan Ran, Jingjie Chen, Jiawei Wang*

Summary: This paper proposes a hybrid digital twin modeling approach that leverages Bi-LSTM networks and parameter consistency-based dynamic updating to accurately track the degradation of industrial robotic arms.

16:00 Tea Break

July 23 [Thursday] Session A in Multifunctional Hall 5

14:00-16:00 **Data-driven Reliability Analysis for In-service Infrastructures**

Moderators: Bin Wu, Northwestern Polytechnical University, China
Dongdong Zhang, University of Shanghai for Science and Technology

14:00-14:15 QR2MSE2026-03-0008 Research on Optimization Design of Height Adjustable Astronaut Seat Headrests / ***Linling Li*** *(Institute of Spacecraft System Engineering), Nan Wen, Yunpeng Zhao, Lei Wang, Peiyao Xi, Jianzhong Yang*

Summary: Balancing strength, stiffness, and height constraints, this study optimizes the force transmission path of astronaut seat headrests, utilizing additive manufacturing to successfully develop and validate a lightweight prototype.

14:15-14:30 QR2MSE2026-03-0038 Ontology-Constrained Multi-Source Evidence for Security Knowledge Graph Construction and Relationship Inference in Network Infor / ***Zhitao Long*** *(Information Support Force Engineering University), Jun He, Chen Feng, Zhiqiang Qu*

Summary: To assess network security protection effectiveness, this paper develops an ontology-constrained, multi-evidence knowledge graph and link-prediction model that resolves heterogeneous evidence conflicts and accurately prioritizes vulnerabilities.

14:30-14:45 QR2MSE2026-03-1019 Multi-Objective Optimization Design of HSPMSMS Based on Small-Sample Kriging and Multi-Objective Ego Strategy / ***Maoheng Ye*** *(University of Shanghai for Science and Technology), Lihui Zhao, Xiaoyan Wang, Dongdong Zhang*

Summary: This study integrates dynamic Kriging surrogate models with efficient global optimization to significantly reduce maximum rotor stress and increase peak torque in high-speed permanent magnet synchronous motors.

14:45-15:00 QR2MSE2026-03-1018 UAV Task Assignment and Path Planning Optimization Considering Battery Capacity Limit under Two-UGV Cooperation / ***Huimin Zuo*** *(Northwestern Polytechnical University), Bin Wu, Wenjin Zhu*

Summary: To minimize system makespan in vehicle-UAV cooperative operations, this paper integrates a subset elimination mechanism with a genetic algorithm, rapidly generating high-quality task partitioning and routing schemes.

15:00-15:15 QR2MSE2026-03-0005 Equivalent modeling and parameter-varying fault injection method for three-pressure distributor valves / ***Qiyang Zuo*** *(Tongji University), Wenchao An, Yuhan Zhang, Bin Zhang, Chao Xu, Limin Shang, Jingxian Ding, Jianyong Zuo*

Summary: Utilizing a validated AMESim lumped-parameter model, this paper efficiently generates extensive fault data for train braking systems, revealing critical micro-leakage behaviors to support data-driven predictive maintenance.

15:15-15:30 **QR2MSE2026-08-0001** Pinn-Based Notch Fatigue Life Prediction Considering Size Effects / ***Hao Ma*** *(University of Electronic Science and Technology of China), Zijian Xu, Changqi Luo, Behrooz Keshtegar, Shunpeng Zhu*

Summary: Embedding stress evolution laws as physical constraints, this paper introduces a physics-informed neural network to predict dynamic critical distances, enabling high-precision, iteration-free fatigue life assessment for complex notched components.

15:30-15:45 **QR2MSE2026-08-1011** A Physics-Informed Hierarchical Multi-Scale Framework for Aero-Engine Remaining Useful Life Prediction / ***Ji Li*** *(Tianjin University), Shuguang He*

Summary: This study develops a physics-informed hierarchical multi-scale framework that explicitly maps aero-engine structural topologies to capture local fault propagation and long-range dependencies, delivering highly competitive remaining useful life predictions.

15:45-16:00 **QR2MSE2026-08-1013** Disturbance-Robust Incremental Fault Diagnosis for Nuclear CRDMs with Theta-Oscillatory Dual-Threshold Voting Spiking Networks / ***Xuezhi Wu*** *(University of Electronic Science and Technology of China), Yuan Wang, Yu Liu*

Summary: This paper introduces a bio-inspired, theta-oscillatory dual-threshold voting framework to stabilize transient fault evidence during class-incremental learning, robustly preventing catastrophic forgetting in nuclear control rod drive mechanism diagnosis.

16:00 Tea Break

July 23 [Thursday] Session B in Multifunctional Hall 1

16:30-18:30 **Reliability Modeling and Risk Analysis**

Moderators: Jihong Pang, Shaoxing University, China
Jingru Zhang, University of Electronic Science and Technology of China, China

16:30-16:45 QR2MSE2026-01-1022 Breaking Through Safety Performance Stagnation of Intelligent Flight Control Systems via Incentivized Criticality Mining / ***Jiao Li*** *(China Aero-Polytechnology Establishment), Wensheng Peng, Zhaoyang Zeng, Jian Zhou, Ruoxuan Bai, Yi Ren, Zili Wang*

Summary: Overcoming the curse of rarity in neural flight control validation, this paper proposes an Incentivized Criticality Mining framework using dense reinforcement learning to actively discover boundary vulnerabilities and accelerate safety assessments.

16:45-17:00 QR2MSE2026-08-0003 Efficient active learning Kriging modeling methods for reliability analysis under random and interval hybrid uncertainties / ***Meide Yang*** *(Hebei University of Technology), Chenhui Liu, Dequan Zhang, Xu Han*

Summary: Addressing random-interval hybrid uncertainties, this study develops highly accurate and efficient active learning Kriging methods tailored to calculate small failure probabilities and solve time-variant multi-mode reliability problems with minimal simulation costs.

17:00-17:15 QR2MSE2026-08-1014 Adaptive Conditional Health Index Fusion for Remaining Useful Life Prediction in Distributed Photothermal Systems / ***Rui Peng*** *(Southwest Petroleum University), Tingyu Zhang, Ke Fei, Donghua Wang, Wei Guo*

Summary: This paper proposes ACM-HIF, an adaptive conditional sensor-fusion framework that screens degradation signals, controls redundancy, and constructs interpretable health indices for reliable RUL prediction in distributed photothermal systems.

17:15-17:30 QR2MSE2026-01-1049 Reliability Assessment of Complex Heat Exchangers Based on Multi-source Life Models Considering Flow Blockage Degradation / ***Suting Zhou*** *(Nuclear Power Institute of China), Lin Zhang, Yanshan Li, Chenhui Li, Junqin Yu*

Summary: An interpretable multivariate trend indicator characterizes running-in behavior of nuclear-grade motor-operated valves under combined stress testing with limited failure labels.

17:30-17:45 QR2MSE2026-01-0003 Reliability model of Ion electric propulsion considering competing failure with shift thresholds / ***Jing Li*** *(Lanzhou Institute of Physics), Yanhui Jia, Xinfeng Sun*

Summary: This paper establishes a competing failure reliability model with shift thresholds for ion electric propulsion systems, comprehensively coupling grid sputtering erosion and unexpected electric breakdown to improve on-orbit life prediction accuracy.

17:45-18:00 QR2MSE2026-01-0038 An FMECA-based assessment on the Reliability of LLM-Assisted Software Development Missions / ***Maochun Tang*** *(AVIC Chengdu Aircraft Design and Research Institute), Jiayi Li, Pengwei Wu, Fangchao Yu, Guohong Ai, Fei Liu*

Summary: Addressing risks in LLM-assisted software development, this paper proposes a task-oriented FMECA method to quantitatively assess potential failure modes, identifying prompt engineering and human review phases as critical targets for mitigation.

18:00-18:15 **QR2MSE2026-08-1012** Structural Reliability Analysis of Aero-Engine Turbine Components Based on Particle Swarm Optimization BP Neural Network / ***Lai Zhang*** *(Dalian University of Technology), Guijie Li*

Summary: To handle complex, highly nonlinear implicit limit state functions in aerospace structures, this paper leverages a PSO-optimized neural network coupled with Monte Carlo simulations to efficiently evaluate structural failure probabilities.

18:15-18:30 **QR2MSE2026-01-0052** Rapid SFINCS-Based Simulation of Typhoon-Induced Compound Flooding and Terrestrial Inundation Extraction in Coastal Ningbo / ***Zijue Wang*** *(Southeast University), Xinxin Yue, Yi Zhang*

Summary: Utilizing Typhoon In-Fa as a case study, this paper develops a rapid SFINCS-based modeling workflow and terrestrial inundation extraction procedure for high-resolution post-event flood assessment and mapping in coastal cities.

18:30 Dinner

July 23 [Thursday] Session B in Multifunctional Hall 2

16:30-17:30 **Korean Reliability Society Activities on Warranty and Maintenance**

Moderators: Dae-Kyung Kim, Chonbuk National University, Korea

16:30-16:45 QR2MSE2026-08-1006 An NHPP-Based Software Reliability Model Incorporating Environmental Uncertainty / ***Kwang Yoon Song*** *(Chosun University), Yeong Seon Kong, In Hong Chang*

Summary: This paper proposes a Non-Homogeneous Poisson Process software reliability model that integrates time-varying fault detection rates and dynamic environmental uncertainties, delivering significantly more accurate failure predictions than conventional static models.

16:45-17:00 QR2MSE2026-027-1001 Field Reliability Estimation Using Two-Dimensional Warranty Claim Data / ***Sang Woo Ha*** *(Hanyang University), Suk Joo Bae*

Summary: This study highlights how customer reporting behaviors near warranty expiration distort field reliability assessments, advocating for multidimensional modeling of product age and usage to improve future performance predictions.

17:00-17:15 QR2MSE2026-027-1002 The Review of Reliability and Maintenance Management for Second-Hand Products / ***Jae-Hak Lim*** *(Hanbat National University), Dae Kyung Kim, Dong Ho Park*

Summary: This paper examines the expanding second-hand product market, highlighting how extending product life cycles through reuse and refurbishment enhances both economic and environmental sustainability in circular economies.

17:15-17:30 QR2MSE2026-025-0006 A Study on Accelerated Degradation Reliability Demonstration Test Design Considering Model Misspecification / ***Hyojung Kim*** *(Chosun University), In-Gyu Choi, Suk-Joo Bae, Seong-Joon Kim*

Summary: To prevent distortion in accelerated degradation reliability demonstration tests, this paper proposes a normalized score aggregation rule that accurately selects between Wiener and general path models to drive cost-effective testing plans.

18:30 Dinner

July 23 [Thursday] Session B in Multifunctional Hall 3

16:30-18:30 **AI-Enhanced Safety and Reliability Assurance for Nuclear Installations**

Moderators: Jun Yang, South China University of Technology, China
Guohua Wu, Shenzhen Technology University, China
Bing Zhang, State Key Laboratory of Nuclear Power Safety Monitoring Technology and Equipmen, China
Zhihui Xu, State Key Laboratory of Nuclear Power Safety Monitoring Technology and Equipment, China
Ming Yang, Shenzhen University, China
Hidekazu Yoshikawa, Kyoto University, Japan
Takeshi Matsuoka, Utsunomiya University, Japan

16:30-16:45 QR2MSE2026-019-1012 Decoupling Inter-Phase Dependencies via Signal Decomposition: Towards Efficient Reliability Analysis of Phased Mission Systems / ***Junnan Qu*** *(South China University of Technology), Zhanyu He, Chuanlong Jiang, Jun Yang, Takeshi Matsuoka*

Summary: This paper innovates Phased Mission System reliability evaluation by employing a signal decomposition approach within the GO-FLOW methodology to rigorously decouple complex inter-phase dependencies and enhance analysis accuracy.

16:45-17:00 QR2MSE2026-06-0006 Symmetry-Aware Reinforcement Learning for Joint Load Allocation And Maintenance / ***Lu Jin*** *(University of Electro-Communications), Mizuki Kasuya, Hyogo Od,*

Summary: Formulating the joint problem as an MDP, this study accelerates deep reinforcement learning performance in continuous load allocation and maintenance optimization by incorporating structural symmetry into a novel auxiliary loss function.

17:00-17:15 QR2MSE2026-08-0002 A Global Distribution Information-Guided Neural Network Surrogate Model for Uncertainty Propagation in Structural Responses / ***Tangzhou Tan*** *(Jinan University), Wei Zhao*

Summary: For data-scarce uncertainty propagation, this study proposes a distribution-aware neural network training strategy that accurately recovers structural response statistics and probability distributions by directly integrating global distributional constraints into the objective function.

17:15-17:30 QR2MSE2026-08-1004 Reliability Analysis Combining Method of Moments With Control Variates / ***Xuanyi Zhang*** *(Beijing University of Technology), Crist´obal H. Acevedo, Marcos A. Valdebenito, Matthias G.R. Faes*

Summary: Combining the Method of Moments with Control Variates, this paper develops a variance reduction technique that efficiently evaluates higher-order performance moments, achieving dimension-independent accuracy for small failure probability estimations.

17:30-17:45 QR2MSE2026-019-1007 Research Review on Modeling and Analysis Methods of Level 3 PSA and Off-Site Nuclear Emergency / ***Hongxing Lu*** *(Shenzhen Technology University), Yirui Guo, Fanghui Ma, Shanshan Chen, Guohua Wu, Wenlin Wang, Muxin Nian, Mengchu Song, Jiahao Huang*

Summary: This comprehensive review of Level 3 Probabilistic Safety Assessment paradigms advocates a critical shift from traditional risk consequence calculation toward safety performance optimization for improved off-site nuclear emergency preparedness.

17:45-18:00 **QR2MSE2026-06-1007** Deep Reinforcement Learning for Reliability-Driven Online Dynamic Condition-Based Maintenance of Railway Axle Box Bearings / ***Chaoqun Hu*** *(Liaoning Railway Vocational and Technical College), Zhe Chen, Yonghua Li, Jun Chen*

Summary: This study implements a deep reinforcement learning framework utilizing a fuzzy operational reliability index to dynamically dictate railway axle box maintenance, consistently surpassing static schedules by adapting to fatigue-driven degradation.

18:00-18:15 **QR2MSE2026-06-1001** Event-Driven Integrated Maintenance And Production Recovery via Gat-Ppo With Daily Recourse for Production Lines / ***Zichun Wang*** *(Shanghai Jiao Tong University), Zhen Chen, Yixi Zhao, Ershun Pan*

Summary: Addressing post-disruption throughput backlogs, this paper proposes an event-driven GAT-PPO framework representing the system as a machine-week graph to optimally coordinate weekly maintenance decisions with daily production recovery schedules.

18:15-18:30 **QR2MSE2026-06-0008** Condition-Based Maintenance Optimization for Two-Scale Degrading Systems Considering Imperfect Maintenance / ***Yue Yang*** *(Tianjin Chengjian University), Yukun Wang*

Summary: This paper develops a Markov decision process model to derive exact, cost-minimizing condition-based maintenance policies for degrading systems subjected simultaneously to time-induced aging and usage-induced wear processes.

18:30 Dinner

July 23 [Thursday] Session B in Multifunctional Hall 4

16:30-18:30 Fault Diagnosis, Prognosis, Condition Monitoring and PHM

Moderators: Zhongwei Deng, University of Electronic Science and Technology of China, China
Kaixuan Feng, Xi'an Jiaotong University, China

16:30-16:45 QR2MSE2026-04-1024 Petroleum Pipeline Defect Prediction Based on 1d-Cnn-Bilstm-A Model / ***Siyu Chen*** *(China University of Petroleum-Beijing at Karamay), Tao Xu, Changyun Li, Lei Xu*

Summary: Replacing subjective manual interpretation, this study proposes a hierarchical 1D-CNN-BiLSTM-Attention deep learning model that automatically and accurately classifies typical ultrasonic non-destructive testing defects in oil and gas pipelines.

16:45-17:00 QR2MSE2026-08-1016 Research on State-of-Health Estimation Methods for Lithium-Ion Batteries Based on Multi-Feature Fusion / ***Xiong Shu*** *(Hunan Engineering University), Kexiang Wei, Linkai Tan, Zhijie Luo, Wenxian Yang*

Summary: This study integrates equivalent circuit models with distribution of relaxation times features and a few-shot target-cell calibration strategy to achieve accurate, cross-cell stable, and mechanistically interpretable battery state-of-health predictions.

17:00-17:15 QR2MSE2026-04-1022 Digital Twin-Driven Virtual Sample Generation for Imbalanced Fault Diagnosis of Rolling Bearing via Pi-Sk-Vmd / ***Puzhou Wang*** *(Jiangxi University of Science and Technology), Zixin Cheng, Yanghui Lin, Yingkui Gu*

Summary: This paper develops a digital twin-assisted virtual sample generator combining physics-informed VMD and dynamic extrapolation to successfully synthesize realistic severe-fault bearing signals and rectify data imbalance in diagnostic models.

17:15-17:30 QR2MSE2026-04-0028 Perception of wing vibrational and rotational compound motion based on dual passive radio frequency tags / ***Shangyuan Li*** *(China University of Mining and Technology), Feng Tian, Litai Lou, Cong Wang, Haibo Yu, Jianhua Yang*

Summary: This paper develops a novel phase spectral model and differential separation method for passive RFID signals, enabling robust, contactless monitoring of compound vibrational and rotational motions in aircraft wings.

17:30-17:45 QR2MSE2026-08-1002 A Physics-Informed Domain Adaptation Network for Lithium-Ion Battery State-of-Health Prediction / ***Jinyi Shi*** *(Southwestern University of Finance and Economics), Hui Xiao*

Summary: This study proposes a physics-informed domain adaptation network that embeds a degradation dynamics network to significantly reduce hypothesis space complexity and improve cross-domain state-of-health prediction accuracy for lithium-ion batteries.

17:45-18:00 QR2MSE2026-08-1007 Reliability Modeling for Multi-State System with Performance Sharing Mechanism Based on Multi-Level Observations / ***Yefang Chen*** *(Southwestern University of Finance and Economics), Hui Xiao*

Summary: Leveraging dynamic Bayesian networks and an expectation-maximization algorithm, this study provides a robust framework to infer unknown transition probabilities and evaluate the reliability of performance-sharing multi-state systems under hierarchical observations.

18:00-18:15 QR2MSE2026-04-1010 Dynamic Analysis of Localized Failures in the Main Thrust Raceway of a Shield Machine'S Main Bearing Using the Slicing Method / ***Wenliao Du***, *Yanwei Ding, Hongchao Wang, Binbin Zhao, Xiaoyun Gong, Fannian Meng, Hanlei Zheng (Zhengzhou University of Light Industry), Lijie Jiang*

Summary: Using a slicing-based contact discretization method, this paper develops a precise roller-raceway dynamic model to extract and validate fault characteristic frequencies for localized defects in shield machine main bearings.

18:15-18:30 QR2MSE2026-04-0022 Fault Diagnosis of Rotating Components under Unseen Conditions Based on Multi-Conditional Diffusion Model / ***Tingyu Qian*** *(Xi'an Jiaotong University), Yi Li, Zilin Zhang, Hanbin Zhou, Tianlei Wang, Qing Ni, Ke Feng*

Summary: To tackle data scarcity under unseen operating conditions, this paper employs a multi-conditional diffusion model to generate synthetic time-frequency samples, successfully training an improved CNN for robust rotating component diagnosis.

18:30 Dinner

July 23 [Thursday] Session B in Multifunctional Hall 5

16:30-18:30 **Reliability and Safety of Coastal and Offshore Infrastructures**

Moderators: Zifei Xu, University of Liverpool, UK
Huanhuan Li, University of Southampton, UK
Zhongchi Liu, University of Lisbon, Portugal
Xiangyu Kong, University of Lisbon, Portugal

16:30-16:45 QR2MSE2026-01-0039 Risk Coupling of Air Traffic Control Unsafe Events Based on the Safety Model / ***Suiyi Bao*** *(Civil Aviation University of China), Zuoao Xu, Zhao Li, Li Li*

Summary: To quantify air traffic control operational risks, this study proposes a semantic-syntactic framework that extracts validated risk couplings from unstructured aviation narratives, revealing critical vulnerabilities in physical resources and air-ground interactions.

16:45-17:00 QR2MSE2026-01-0040 Reliability Analysis for Aircraft Door Mechanism Based on Coupled eRBF-FCV-WC and Surrogate-Form / ***Yujia Jin*** *(Chang'an University),Yue Hu, Deyin Jiang, Jingyi Liu, Huan Pang*

Summary: This paper proposes an enhanced radial basis function surrogate coupled with fast cross-validation and weighted clustering to highly efficiently evaluate the geometric uncertainty and failure probability of aircraft door retraction mechanisms.

17:00-17:15 QR2MSE2026-017-0005 LLM-Augmented Bayesian Network for Maritime Cybersecurity: a Comparative Experimental Study / ***Yunfeng Zhao*** *(Liverpool John Moores University), Huanhuan Li, Trung Thanh Nguyen, Christian Matthews, Zaili Yang*

Summary: To enhance maritime cybersecurity risk assessment, this study develops an LLM-driven text-mining pipeline to systematically extract risk factors from incident reports, constructing scalable Bayesian Network models with competitive predictive performance.

17:15-17:30 QR2MSE2026-017-0003 Fatigue Life Assessment of the Rack-and-Pinion in Jacking Systems for Offshore Wind Turbine Installation Vessels / ***Xu Han*** *(Yantai Research Institute of Harbin Engineering University), Shuyu Liu, Yan Dong, Shuzheng Sun, Jing Liu, Langjun Xu*

Summary: This study presents a numerical method to predict the fatigue life of offshore wind turbine installation vessel rack-and-pinion systems, revealing that wear-fatigue coupling effects significantly reduce service life compared to root fatigue alone.

17:30-17:45 QR2MSE2026-017-0007 Fatigue Crack Growth Analysis of Jack-Up Rig Legs Based on Time-Domain Wave Loads / ***Xiaoyu Wu*** *(Yantai Research Institute of Harbin Engineering University), Lingsu Liu, Yan Dong, Shuzheng Sun, Jing Liu, Langjun Xu*

Summary: Investigating jack-up rig structural integrity, this study employs time-domain wave load analysis and the ANSYS smart method to simulate 3D fatigue crack growth, demonstrating how residual tensile stresses accelerate weld degradation.

17:45-18:00 **QR2MSE2026-01-1019** Fault Propagation Modeling and Dynamic Reliability Assessment of Shipboard Regional Power Distribution Systems Considering State Entropy Diffusion / ***He Lu*** *(North China Electric Power University), Heping Jia*

Summary: This paper proposes a vectorized Monte Carlo dynamic reliability assessment method for shipboard power systems, embedding a state entropy diffusion model to accurately track fault propagation and identify critical degradation chains.

18:00-18:15 **QR2MSE2026-01-1036** Multi-Agent Reinforcement Learning Based Bi-Objective Markov Decision Process for Reliability Optimization of Dynamic Reconfigurable Systems / ***Ling Li*** *(Southwestern University of Finance and Economics), Hui Xiao*

Summary: This study develops a bi-objective Markov decision process model solved by multi-agent reinforcement learning to dynamically optimize reconfigurable battery networks, balancing long-term system reliability against module degradation imbalance.

18:15-18:30 **QR2MSE2026-01-0017** Evaluation of Hthp MWD Sea Trial Effectiveness Integrating Tfahp and FCE Methods / ***Wenbo Zhao*** *(Qingdao University of Science & Technology), Chao Liu, Ju Wang, Shuai An, Zhenghao Wang, Hongyan Wang*

Summary: To evaluate deep-sea drilling instruments, this research proposes an integrated framework combining Triangular Fuzzy Analytic Hierarchy Process and Fuzzy Comprehensive Evaluation, providing a data-driven tool for assessing extreme-condition performance bottlenecks.

18:30 Dinner

July 24 [Friday] Session C in Multifunctional Hall 1

14:00-16:00 **Robust, Reliability-Based, and Lifecycle Design**

Moderators: Jinhua Mi, University of Electronic Science and Technology of China, China
Lechang Yang, University of Science and Technology Beijing, China

14:00-14:15 QR2MSE2026-05-0007 Importance identification of engineering characteristics based on conflict-aware dual-pathway graph neural network / ***Guangquan Huang*** *(Kunming University of Science and Technology), Liming Xiao, Yaqi Ding, Tingqiang Yao*

Summary: This study presents a conflict-aware dual-path graph neural network that effectively resolves physical contradictions and complex dependencies between customer requirements and engineering characteristics in mechanical system design.

14:15-14:30 QR2MSE2026-05-1008 A Reliability-Oriented Method for Material Selection and Combination Based on the Pareto and Pearson Indices / ***Mingfang Chen*** *(China Nuclear Power Engineering Co., Ltd.), Zhuoheng Ye, Tao Wang*

Summary: To eliminate measurement disputes in engineering procurement, this paper utilizes Pareto principles and Pearson correlations to quantify, screen, and intelligently consolidate price-adjustable composite materials into standardized contract structures.

14:30-14:45 QR2MSE2026-05-0004 Optimization Method for Quality Consistency of Withdrawal Force of Twist Pin Contact Based on Robust Design Principle / ***Changxi Chen*** *(Harbin Institute of Technology), Le Xu, Ziyang Wang*

Summary: Applying cantilever beam theory and Monte Carlo virtual assembly, this study systematically optimizes the geometric parameters and tolerance allocations of micro rectangular twist pin contacts to significantly improve withdrawal force consistency.

14:45-15:00 QR2MSE2026-05-0008 Robust Layup-Group Optimisation of a Composite Marine Propeller Under Manufacturing Angle Tolerance / ***Meipeng Yang*** *(Jimei University), Kuan Fan, Yingqiang Cai, Qinglin Chen, Miaojiao Pen, Yezhi Qin, Ying Wang*

Summary: This paper proposes a robust optimization method coupling CFD and FEA responses within the manufacturing tolerance domain to efficiently evaluate reliability and control ply-group angle deviations in composite marine propellers.

15:00-15:15 QR2MSE2026-05-1011 Research on the Evolutionary Characteristics of Safety Helmet Mechanical Properties Under Impact Loads / ***Meng Tang*** *(Chongqing University of Science and Technology), Yuanjian Yang, Yiquan He, Hao Lu, Xinyue Liang*

Summary: Conducting detailed 3D dynamic impact simulations, this study quantifies the optimal balance between shell thickness and crown curvature radius to maximize energy absorption and improve industrial safety helmet performance.

15:15-15:30 **QR2MSE2026-01-0030** Precision Reliability Analysis of Single-Row Four-Point Contact Ball Slewing Bearing Considering Assembly Misalignment / ***Wenqing Yang*** *(China University of Mining and Technology), Yonghui He, Hao Lu, Shitao Yang, Yang Li, Yuheng Chen*

Summary: Investigating assembly misalignment in slewing bearings, this study establishes a dynamic model and proposes a Chebyshev-AK-MCS interval-random hybrid method to efficiently analyze uncertainty and provide theoretical support for tolerance optimization.

15:30-15:45 **QR2MSE2026-01-0045** Mission Success Probability Modeling for Usvs Using Hierarchical Structures and Dynamic Functional Weighting / ***Junxia A*** *(Jiangsu University of Science and Technology), Xiaofang Luo, Xu Bai, Linghui Guo, Peixun Li*

Summary: Correcting static evaluation biases, this study proposes a hierarchical mission success probability assessment framework for Unmanned Surface Vehicles, incorporating a dynamic weighting mechanism to reflect shifting subsystem importance across mission stages.

15:45-16:00 **QR2MSE2026-01-1045** A Three-Dimensional Mbse Framework for Full-Lifecycle Reliability Evaluation of Streak Camera Systems / ***Jianqi He*** *(University of Electronic Science and Technology of China), Huabing Du, Liqiong Xia, Jin Li, Jinhua Mi*

Summary: Addressing the lack of standardized assessment for ultrafast diagnostic tools, this paper proposes an MBSE-grounded framework to systematically evaluate the full-lifecycle reliability, manufacturing quality, and operational stability of streak camera systems.

16:00 Tea Break

July 24 [Friday] Session C in Multifunctional Hall 2

14:00-16:00 **Physics-Informed AI for Reliability Engineering and Intelligent Maintenance**

Moderators: Zhen Chen, Shanghai Jiao Tong University, China
Tangbin Xia, Shanghai Jiao Tong University, China
Ershun Pan, Shanghai Jiao Tong University, China

14:00-14:15 QR2MSE2026-023-0006 Data-Driven Fault Propagation and Reliability Analysis in Aerospace Systems / ***Yu Hao*** *(China Aero-Polytechnology Establishment), Wensheng Peng, Shumao Qiu, Changdong Zheng, Ruoxuan Bai*

Summary: Leveraging LLMs to standardize over 20,000 aviation fault reports, this study develops an Enhanced Knowledge Graph and multi-stage framework to elucidate complex fault propagation mechanisms across aerospace system lifecycles.

14:15-14:30 QR2MSE2026-023-0004 Similarity-aware pruning for federated bearing RUL prediction via dual-domain degradation representation learning / ***Xin Cheng*** *(Shanghai Jiao Tong University), Qianqian Zhang, Jiawei Wang, Xinxin Wang, Tangbin Xia, Ershun Pan*

Summary: This paper proposes a communication-efficient federated framework for bearing remaining useful life prediction, combining similarity-aware update pruning and sparse uplink mechanisms to maintain predictive accuracy while significantly reducing network payload.

14:30-14:45 QR2MSE2026-023-0007 Supervised Machine Learning Framework for Cargo Throughput Prediction At Tema Port / ***Ted Andrew Tsike*** *(Hubei University of Automotive Technology), Kobina Agbodah, Isyaku Muhammad, Mustapha Muhammad, Nana Boa Benfor*

Summary: Utilizing historical operational data from Tema Port, this study evaluates an autoregressive machine learning framework, demonstrating that lightweight linear regression models can successfully outperform naive baselines for reliable short-term cargo forecasting.

14:45-15:00 QR2MSE2026-023-0008 Modelling of Moving Contact-reed Riveting in Relays and Analysis of Factors Affecting Riveting Quality / ***Kai Zhang*** *(Harbin Institute of Technology), Wenying Yang, Lanxiang Liu, Ru Wang*

Summary: Investigating joint stability in balanced-force relays, this study uses finite element simulations and experimental measurements to optimize reed thickness, contact diameter, and contact height, thereby minimizing riveting interference defects.

15:00-15:15 QR2MSE2026-023-0003 A federated transfer learning framework for rolling bearing fault diagnosis under cross-condition heterogeneity / ***Feng Luo*** *(Shanghai Jiao Tong University), Isabelle Ji, Ran Hu, Zishen Zhang, Tangbin Xia, Lifeng Xi*

Summary: Addressing cross-condition data heterogeneity, this paper proposes a federated transfer learning framework with a multi-scale residual network and layer-wise alignment to ensure privacy-preserving, robust intelligent fault diagnosis for rotating machinery.

15:15-15:30 QR2MSE2026-023-1001 Ar-Caps: Reliability-Propagated Causal Discovery Under Multivariate Spike Contamination / ***Yang Hu*** *(Donghua University), Di Zhou*

Summary: To mitigate the impact of abnormal samples on observational data, this paper presents Adaptive-Robust-CaPS, introducing weighted Stein Hessian estimation to improve the robustness and reliability of multivariate causal structure learning.

15:30-15:45 QR2MSE2026-019-1005 Research on Interpretable Intelligent Decision-Making Methods for Operation Decision Optimization of Sodium-Cooled Fast Reactors / ***Peilin Li*** *(Shenzhen University), Sijuan Chen, Yingfei Ma, Zhang Ming, Jipu Wang, Yang Ming, Yunlong Zhou, Yunfei Nie, Xingjie Lin*

Summary: This study integrates Multilevel Flow Modeling, state discretization, and Markov Decision Processes to develop interpretable, physically consistent, and traceable operation and maintenance decision policies for Sodium-Cooled Fast Reactors.

15:45-16:00 QR2MSE2026-04-0003 Robust Multi-Sensor Bearing Fault Diagnosis Under Sensor Missingness / ***Liang Yan*** *(Shanghai Jiao Tong University), Shichang Du, Shuo Wang, Haitong Luo, Shanshan Li, Xianmin Chen*

Summary: Addressing missing sensor channels, this paper proposes a reliability-guided expert-fusion framework that dynamically weights trustworthy evidence, ensuring robust intelligent bearing fault diagnosis in non-ideal industrial monitoring environments.

16:00 Tea Break

July 24 [Friday] Session C in Multifunctional Hall 3

14:00-16:00 **Reliability Modeling and Risk Analysis**

Moderators: Xin Liu, Changsha University Of Science & Technology China
Huaming Qian, University of Electronic Science and Technology of China, China

14:00-14:15 QR2MSE2026-01-1029 Reliability Analysis and Error Distribution Fitting of the Axial Compressive Strength Model for Cross-Shaped Steel-Concrete Composite Columns with Tension Members / ***Mingfang Chen*** *(China Nuclear Power Engineering Co., Ltd.), Fenglin Zhang, Xinhua Yu*

Summary: Based on finite element simulation data, this study evaluates existing strength models for cross-shaped steel-concrete composite columns, defining uncertainty coefficients and suggesting the gamma distribution for accurate member resistance prediction.

14:15-14:30 QR2MSE2026-01-0008 Stochastic Resource Allocation Optimization for System Resilience Enhancement Based on Component Importance Measure / ***Xiangyu Qin*** *(Northwestern Polytechnical University), Bei Wu, Ada Che*

Summary: Addressing random disruptions in critical infrastructures, this study develops a phase-aware importance measure and tailored algorithm to optimize resilience-driven resource allocation for heterogeneous components in multi-phase operations.

14:30-14:45 QR2MSE2026-01-0034 Dynamic Risk Analysis of Coupled Failures between Digital I&C and Process Systems / ***Yudan Li*** *(Shenzhen University), Ming Yang, Chenxi Zhang, Ying Liu, Hongchi Zhou*

Summary: Integrating Multilevel Flow Modeling and Dynamic Flowgraph Methodology, this study proposes a dynamic risk analysis method to interpret causal paths and evaluate coupled failures between nuclear digital instrumentation and process systems.

14:45-15:00 QR2MSE2026-01-1034 Reliability Assessment of Multivariate Precision Degradation in CNC Rotary Tables Using a Wiener Process–D-Vine Copula Model / ***Peng Chen*** *(Chongqing University), Yan Ran, Maolin Zheng*

Summary: To address stochastic degradation in CNC rotary tables, this paper proposes a multivariate reliability assessment method integrating the Wiener process and D-Vine Copula to effectively model heterogeneous dependencies among accuracy parameters.

15:00-15:15 QR2MSE2026-01-0014 Optimal Design of Simple Step-Stress Accelerated Life Tests for Nadarajah-Haghighi Distribution under Progressive Type I Censo / ***Meiqi Zhang*** *(Hebei University of Science and Technology), Xia Cai, Yiling Zhang*

Summary: This study investigates the optimal design of simple step-stress accelerated life tests under progressive Type I censoring using the Nadarajah-Haghighi distribution, employing Bayesian methods and Monte Carlo simulations to minimize pre-posterior variance.

15:15-15:30 QR2MSE2026-01-0051 Random Vibration Fatigue Reliability Analysis of a ZnAl4 Yacht Lock Considering Marine Corrosion Degradation / ***Rui Wang*** *(Jimei University), Yingqiang Cai, Qinglin Chen, Miaojiao Pen, Kuan Fan, Yezhi Qin, Xuance Wang*

Summary: This study proposes a fatigue reliability sensitivity analysis method for marine yacht locks, combining finite element random vibration simulations with Monte Carlo post-processing to assess degradation under coupled corrosion and vibration.

15:30-15:45 QR2MSE2026-01-0036 Mission Abort in Balanced Multi-Sector Systems: A Two-Stage Markov Model / ***Zifan Han*** *(Northwestern Polytechnical University), Meiyan Li, Bei Wu, Chen Fang*

Summary: This study develops a two-stage continuous-time Markov chain framework to evaluate and jointly optimize abort thresholds and eligibility deadlines for multi-sector balanced systems, effectively trading off mission completion and survivability.

15:45-16:00 QR2MSE2026-01-1021 A Multi-Modal Risk Control Framework for Cultural Image Generation Based on Semantic and Structural Consistency / ***Xiaozhe Qin*** *(Beijing Information Science & Technology University), Lei Che, Yating Fang, Tianyan Zhang, Hongrui Zhang*

Summary: Reformulating image generation evaluation as a risk detection problem, this paper proposes a lightweight multimodal framework integrating semantic consistency with facial structural proxies to robustly identify high-risk culturally grounded images.

16:00 Tea Break

July 24 [Friday] Session C in Multifunctional Hall 4

14:00-16:00 **Fault Diagnosis, Prognosis, Condition Monitoring and PHM**

Moderators: Weiwen Peng, Sun Yat-sen University, China
Yuan Wang, University of Electronic Science and Technology of China, China

14:00-14:15 QR2MSE2026-04-1007 A Contrastive Learning-Driven Spatiotemporal Framework for Lithium-Ion Battery Fault Diagnosis and Cell-Level Localization / ***Wenjing Zheng*** *(University of Electronic Science and Technology of China), Likang Zhang, Zhongwei Deng*

Summary: Combining a weight-shared LSTM encoder with supervised contrastive learning, this framework simultaneously achieves highly accurate vehicle-level fault diagnosis and precise cell-level anomaly localization for battery safety management.

14:15-14:30 QR2MSE2026-04-1027 RDME-GAT: A Robust Graph Attention Network with Dynamic Multi-Scale Feature Enhancement for Small-Sample Fault Diagnosis / ***Haoyu Wang*** *(University of Electronic Science and Technology of China), Hao Tian, Jinhua Mi, Shuang Xia, Yanfeng Li*

Summary: This paper proposes a robust graph attention network utilizing adaptive structural perturbations and dynamic multi-scale feature enhancement to overcome severe data imbalance and noise interference in complex industrial diagnostics.

14:30-14:45 QR2MSE2026-04-0014 Study on the Fault Diagnosis of Marine Gearboxes Using ResNet-Transformer with Attention Mechanisms / ***Zhe Tong*** *(Beijing University of Technology), Wei Fan, Qiang Cheng, Tao Zhang, Jingjing Xu, Ying Li*

Summary: For highly non-stationary vibration signals, this paper proposes a ResNet-Transformer diagnostic model equipped with dual-dimensional attention to accurately capture both local features and global long-term dependencies in ship gearboxes.

14:45-15:00 QR2MSE2026-04-0015 Joint Dual-Path Distribution Alignment and Supervised Contrastive Learning for Cross-Condition Bearing Fault Diagnosis / ***Jiandong Nie*** *(Harbin Engineering University), Jingbo Gai , Xuejiao Du*

Summary: Overcoming the limitations of single-path distribution alignment, this study introduces a dual-path framework paired with supervised contrastive learning to significantly improve cross-condition bearing fault diagnostic accuracy and feature discriminability.

15:00-15:15 QR2MSE2026-04-0017 Forecast of the Remaining Useful Life of Lithium Batteries based on MVMD-Transformer-BiLSTM Fusion / ***Wenpeng Si*** *(Xinjiang University), Jiwei Wang*

Summary: This study proposes a predictive framework integrating multivariate variant modal decomposition with a Transformer-BiLSTM network to accurately capture degradation inflection points and forecast lithium battery remaining useful life.

15:15-15:30 QR2MSE2026-04-1026 A Study on Intelligent Identification Methods for Gas-Liguid Two-Phase Flow Patterns in Inclined Pipes under Caussian Noise Conditions / ***Qi Zhang*** *(Chongqing University of Science and Technology), Yuanjian Yang, Zihao Zhang, Wangbo Ning*

Summary: To classify gas-liquid flow regimes under noisy inclined-pipe conditions, this paper proposes a robust deep learning framework integrating dual-domain residual enhancement and multiscale feature extraction for accurate pattern recognition.

15:30-15:45 **QR2MSE2026-04-1017** Evidence-Weighted Bayesian Network for Fault Source Ranking in Launch Vehicle Telemetry Anomalies / ***Jialong Chen*** *(Shanghai Jiao Tong University), Zirong Wang, Huan Yu, Zhen Chen*

Summary: This paper proposes an evidence-weighted Bayesian network that maps physical signal chains and engineering logic to generate highly explainable, auditable troubleshooting priorities for scarce launch vehicle electrical telemetry anomalies.

15:45-16:00 **QR2MSE2026-04-1009** Sub-Pixel Surface Displacement monitoring of wind turbine blades using a flownets-based convolutional netural network / ***Wenhao Yang*** *(Lanzhou University of Technology), Jing Zhao, Dewang Li, Zhi Cui, Zongwen An*

Summary: Overcoming the limitations of conventional image correlation, this paper proposes BladeNet, a customized convolutional neural network capable of highly accurate, sub-pixel surface displacement monitoring for wind turbine blade deformation.

16:00 Tea Break

July 24 [Friday] Session C in Multifunctional Hall 5

14:00-16:00 **Failure Physics, Material Science, Data Analysis, and Reliability Testing**

Moderators: Song Bai, Southwest Petroleum University, China
Wei Li, Hefei University of Technology, China

14:00-14:15 QR2MSE2026-07-1017 Study on Magnetic Field Shielding Effectiveness of Aluminium Alloy Material with Surface Nickel Plating / ***Siqi Wei*** *(China Academy of Engineering Physics), Fengjie Sun, Hao Huang, Zhengchao Tan, Jinghui Chen*

Summary: Utilizing a validated digital Helmholtz coil model, this simulation study demonstrates that chemically plating aluminum alloy substrates with nickel thicknesses exceeding 10 μm provides magnetic field shielding effectiveness better than 30 dB.

14:15-14:30 QR2MSE2026-019-1008 Research on Dynamic Dispatch Decision of Nuclear Emergency Based on Two-Stage Robust Optimization and Multi-Agent Simulation / ***Wenlin Wang*** *(Shenzhen Technology University), Hongxing Lu, Wenqi Li, Fanghui Ma, Yiping Zeng, Guohua Wu, , Haichuan Zhang, Jiahao Huang, Zekai Mei*

Summary: To resolve supply-demand mismatches during nuclear emergencies, this study integrates Two-Stage Robust Optimization with Agent-Based Modeling, offering a dynamic resource dispatch strategy that significantly improves worst-case material coverage.

14:30-14:45 QR2MSE2026-07-0015 Machine Learning-Based Fatigue Life Prediction of Aluminium Alloys with Curve Calibration / ***Tao Zhou*** *(Inner Mongolia University of Science and Technology), Chao Zhang, Xinyu Ge, Jin Li, Xiaofeng Zhou*

Summary: This study develops a robust machine-learning framework combining residual correction models and a two-support affine curve calibration strategy to significantly improve fatigue life prediction accuracy for aluminum alloys across diverse testing conditions.

14:45-15:00 QR2MSE2026-07-1002 Determination of Minimum Sample Size for Pyrotehnic DeviceS Reliability Assessment Based on Normal Tolerance Limits / ***Jialin Sun*** *(Beijing Institute of Technology), Yeshu Zhang, Shiyao Feng, Liang Xv, Huina Mu*

Summary: Based on normal tolerance limits, this paper mathematically establishes the relationships among design margin, variation coefficients, and minimum sample sizes to provide quantitative guidance for the reliability evaluation of one-shot pyrotechnic devices.

15:00-15:15 QR2MSE2026-07-1019 A Residual Gated Descriptor Fusion Network for Fatigue Strength Prediction of Ferrous Alloys / ***Chengcheng Guo*** *(Southwest Petroleum University), Song Bai*

Summary: To avoid redundant feature learning, this paper proposes a residual gated descriptor fusion network that adaptively controls weak-feature correction strengths, achieving superior fatigue strength prediction accuracy for ferrous alloys.

15:15-15:30 QR2MSE2026-07-1021 Phased Array Ultrasonic Technology of Valve Stem Defect Detection / ***Yiquan He*** *(Chongqing University of Science and Technology), Yuanjian Yang, Qiyang Li, Sutong Lv, Xinyue Liang*

Summary: This study develops a unified, simulation-guided phased array ultrasonic testing procedure integrating sectorial scanning and single-point focusing to precisely detect and quantify microcracks and pitting in structurally complex valve stems.

15:30-15:45 QR2MSE2026-07-1022 Analysis of Erosion Characteristics and Construction of Prediction Formula for Elbow / ***Wangbo Ning*** *(Chongqing University of Science and Technology), Yuanjian Yang, Meng Tang, Yonglong Tang, Xinyue Liang*

Summary: Through CFD-DPM numerical modeling and orthogonal experiments, this study establishes a highly accurate power-law empirical equation to predict gas-solid erosion rates in shale-gas elbows, isolating gas velocity as the dominant degrading factor.

15:45-16:00 QR2MSE2026-01-0048 Safety Analysis of a Fuze Based on Fault Tree and Bayesian Network / ***Huarong Zhong*** *(Northwestern Polytechnical University), Songzhe Liu, Yajie Peng, Zhiqiang Cai*

Summary: This paper constructs a fault tree model of inadvertent fuze operation and maps it into a Bayesian network to systematically perform probabilistic inference, sensitivity analysis, and launch safety risk assessment.

16:00 Tea Break

July 24 [Friday] Session D in Multifunctional Hall 1

16:30-18:00 **Reliability-centric Lifecycle Management for Marine and Offshore Assets**

Moderators: Mingxin Li, The University of Tokyo, Japan
Depeng Liu, China University of Petroleum, China
Haoran Ye, Dalian Maritime University, China
Chenfeng Huang, Dalian Maritime University, China
Yu Sun, Harbin Engineering University, China

16:30-16:45 QR2MSE2026-04-1038 Learnable Wavelet Kernel Dictionary with Self-Supervised Perfect-Reconstruction Constraints for Multimodal RUL Prediction / ***Yuan Wang*** *(University of Electronic Science and Technology of China), Zhenghua Chen , Yu Liu*

Summary: A self-supervised learnable wavelet dictionary improves multimodal gear-system RUL prediction by adapting wavelet kernels while preserving perfect-reconstruction physical consistency.

16:45-17:00 QR2MSE2026-021-1003 Real-Time Spatial Configuration Reconstruction of Marine Risers Based on Particle Swarm Optimization / ***Xiang Liu*** *(China University of Petroleum (Beijing)), Xingyu An, Depeng Liu*

Summary: Addressing deep-sea monitoring challenges, this paper proposes a riser configuration inversion method using inclination information and particle swarm optimization, demonstrating significantly higher spatial reconstruction accuracy than traditional direct integration techniques.

17:00-17:15 QR2MSE2026-021-1004 Edge-Oriented Lightweight Fault Identification of Wave Energy Converter Gearboxes / ***Yu Sun*** *(Harbin Engineering University), Zhimin Cheng, Guangshuai Sun, Zhuang Kang, Jichuan Kang*

Summary: Enabling real-time on-site monitoring for wave energy converters, this paper proposes EfficientFaultNet, a lightweight, edge-deployable deep learning framework that effectively extracts and fuses multi-resolution features for robust gearbox fault diagnosis.

17:15-17:30 QR2MSE2026-02-0007 A Closed-Loop Reasoning Framework for Uncertainty-Driven Reliability Analysis / ***Yuxin Li*** *(Xi'an Jiaotong University), Yonggang Song, Jing Chai, Rongxi Wang, Jianmin Gao, Zhao Wang*

Summary: Merging structured symbolic reasoning with advanced large language models, this collaborative framework integrates knowledge graphs and adapted foundation models to achieve highly accurate, explainable, and adaptable system reliability analyses.

18:30 Banquet

July 24 [Friday] Session D in Multifunctional Hall 2

16:30-17:30 **Data-driven Reliability Analysis for In-service Infrastructures**

Moderators: Yi Zhang, Southeast University, China
Zhaohui Lu, Beijing University of Technology, China
Peipei Li, Beijing University of Technology, China
Yide Zheng, Shenzhen University, China

16:30-16:45 QR2MSE2026-022-0003 A Soft Calibration Method for Microwave Nondestructive Testing Equipment for Gas Pe Pipe Butt Fusion Joints / ***Zhouliang Yu*** *(China Jiliang University), Qiang Wang, Shuguo Yang*

Summary: To mitigate measurement variability in microwave nondestructive testing of polyethylene pipe joints, this paper proposes a reference-response-based soft calibration method that effectively enhances inter-class discrimination and data consistency.

16:45-17:00 QR2MSE2026-022-0005 A Study on a Multi-Failure-Mode Reliability Analysis Method for Active Learning Enhanced by Physical Information / ***Chenqing Li*** *(Zhejiang University of Technology), Wang Xiang, Yongyong Xiang, Yifan Li, Baisong Pan*

Summary: Enhancing reliability analysis for multi-failure mode systems, this paper proposes a physics-enhanced active learning framework combined with t-Copula to accurately and robustly evaluate small failure probabilities with reduced computational cost.

17:00-17:15 QR2MSE2026-01-1025 A Time-Dependent Alpha Factor Model for Common Cause Failure Analysis of Degrading Redundant Systems / ***Qijie Sun*** *(Shenzhen University), Sijuan Chen, Yingxin Liang, Jipu Wang, Yingfei Ma, Min Zhang, Yu Zeng, Yunfei Nie*

Summary: This paper extends the classical alpha factor model by proposing a time-varying common cause failure probability analysis method that incorporates degradation asymmetry and Bayesian updating to dynamically assess redundant system risks.

17:15-17:30 QR2MSE2026-01-0050 Analysis of Impact Loads on Emb Actuators Based on Vehicle Operation Big Data / ***Jingfei Fu*** *(University of Shanghai for Science and Technology), Dongdong Zhang, Xiaoyan Wang, Lihui Zhao*

Summary: By developing a lumped-parameter dynamic model, this study investigates the transient impact characteristics of electro-mechanical brake actuators under real-world conditions, providing crucial support for durability-oriented design and reliability assessment.

18:30 Banquet

July 24 [Friday] Session D in Multifunctional Hall 3

16:30-18:15 Synergistic AI and Advanced Modeling for Quality, Reliability, Maintainability, and PHM: Integration and Aggregation

Moderators: Cheng-Geng Huang, University of Electronic Science and Technology of China, China
Xiangyu Li, Taiyuan University of Technology, China
Junyu Guo, Southwest Petroleum University, China
Xianhui Yin, Qingdao University, China
Zhaomin Zhang, Civil Aviation University of China, China

16:30-16:45 QR2MSE2026-024-1002 Synergizing Multi-Head Attention and LLM-Driven Chain-Of-Thought For Joint Entity And Relation Extraction In Industrial O&M Logs / ***Chenggeng Huang*** *(University of Electronic Science and Technology of China), Tingle Tang, Haohan Zhang, Rui Sun, Yi Huang, Changhao Men*

Summary: Synergizing Multi-Head Attention with LLMs, this study proposes an innovative joint extraction framework utilizing Chain-of-Thought prompting to accurately construct robust knowledge graphs from complex, unstructured industrial operation and maintenance data.

16:45-17:00 QR2MSE2026-03-0031 Mission Abort Policy for K/N System under Multi-Phased Degradation / ***Xin Gao*** *(Taiyuan University of Technology), Xiangyu Li, Xiaoyan Xiong*

Summary: To balance mission success and system survivability in multi-phased operations, this study develops a bivariate mission abort policy for UAV swarms, mathematically maximizing the overall system reward.

17:00-17:15 QR2MSE2026-03-0037 Wear Life Model Research of Diesel Engine Valve / ***Deqi Kang*** *(Taiyuan University of Technology), Xiaopeng Chang, Yao Qiu, Xiangyu Li, Xiaoyan Xiong*

Summary: Integrating degradation-sensitive features and Monte Carlo uncertainty quantification, this paper proposes ValveLifeNet, a multi-source deep learning model that provides highly accurate, risk-informed wear life predictions for industrial valves.

17:15-17:30 QR2MSE2026-03-0032 A multi-objective sequence decision-making of multi-phased UAVs with multiple performance thresholds and mixed shocks effect / ***Chen Ren*** *(Taiyuan University of Technology), Xiangyu Li, Yizhao Li, Xingshuo Wang, Xiaoyan Xiong*

Summary: This paper proposes a gamma-process-based multi-phase degradation model and an encoded particle swarm optimization algorithm to adaptively generate multi-objective operational sequences for unmanned aerial vehicles in complex environments.

17:30-17:45 QR2MSE2026-03-1016 Co-Design of Evtol with Flight Quality and Energy Consumption / ***Yan Zhou*** *(Hefei University of Technology), Wei Li*

Summary: Overcoming the inefficiencies of decoupled design processes, this paper adopts a bi-level co-design optimization framework that simultaneously optimizes eVTOL physical parameters and flight controllers for enhanced energy efficiency.

17:45-18:00 QR2MSE2026-01-0031 Shock-Driven Dynamic Data Backup and Mission Abort Decisions for Cloud Computing Systems / ***Zhengxia Qiu*** *(Beijing Institute of Technology), Dongfang Liu, Qingan Qiu, Jiancai Wang*

Summary: For cloud platforms facing random external shocks, this paper develops a multidimensional state-dependent policy to jointly coordinate backup and mission abort decisions, maximizing mission success probability and minimizing expected losses.

18:00-18:15 QR2MSE2026-03-0002 Optimal Maintenance Policy for Series Systems Based on The Proportional Hazards Model Under Reliability Constraints / ***Jiaxin Qi*** *(Wenzhou University), Jiantong Che, Yinshuang Chen, Ning Zhang, Wenchun Che*

Summary: This paper develops a PHM-based maintenance policy for series systems, optimizing preventive and opportunistic thresholds under reliability constraints to reduce costs in wind-turbine cases.

18:30 Banquet

July 24 [Friday] Session D in Multifunctional Hall 4

16:30-18:00 **Fault Diagnosis, Prognosis, Condition Monitoring and PHM**

Moderators: Wubin Cai, Southwest Jiaotong University, China
Qin Zhang, University of Electronic Science and Technology of China, China

16:30-16:45 QR2MSE2026-04-0027 Sample Selection and Contrastive Learning-Based Fault Diagnosis of Aviation Plunger Pump under Long-Tailed Data with Noisy Label / ***Kaiwei Yu*** *(Huazhong University of Science and Technology), Weixiong Jiang, Peikun Yin, Jun Wu, Chao Deng*

Summary: This study proposes a sample selection and contrastive learning method that isolates mislabeled data and mitigates class imbalance, ensuring robust fault diagnosis of aviation plunger pumps under long-tailed distributions.

16:45-17:00 QR2MSE2026-04-0031 Equivalent Conicity Estimation Using a Multi-View Inception1d-Tcn Model / ***Feng Liu*** *(Southwest Jiaotong University), Wubin Cai, Hanliang Tao, Maoru Chi*

Summary: Formulating equivalent conicity estimation as a dual-axis regression task, this study proposes a multi-view Inception1D-TCN model that extracts axle-coupled features from lateral vibration responses for railway vehicle monitoring.

17:00-17:15 QR2MSE2026-04-0036 Time-Frequency Surfaces and Discrete Ricci Flow Method for Fault Diagnosis / ***Haoran Xu*** *(Shanghai Jiao Tong University), Yixiang Huang, Xinyi Long, Chunqi Wang, Liucheng Tang, Chengliang Liu*

Summary: This paper develops a highly interpretable diagnostic approach by transforming continuous wavelet transform surfaces into flattened geometric domains via discrete Ricci flow, cleanly isolating local deformations from fault impulses.

17:15-17:30 QR2MSE2026-04-0040 Multi-Dimensional Operational Risk Assessment of ADAS-Equipped Buses: An Improved BWM Framework / ***Guoqi Sun*** *(Qinghai Minzu University), Hao Chen, Chengshan Yi, Shanshan Wang, Jiang Chen*

Summary: This study combines multi-criteria decision-making and a Proportional Hazards Model to predict early-warning intervention mileages for ADAS-equipped public buses.

17:30-17:45 QR2MSE2026-04-1008 An LLM-Driven Rag+Qlora Framework for Bearing Fault Diagnosis and Maintenance Recommendation / ***Xuanhui Luo*** *(Beihang University), Chao Zhang, Rentong Chen, Xingjian Wang, Yuwei Zhang, Shaoping Wang*

Summary: This study adapts an LLM with QLoRA to classify bearing faults from vibration descriptors and generate readable mechanical maintenance recommendations.

17:45-18:00 QR2MSE2026-04-1032 A Dual Convolutional Autoencoder Approach for Bearing Fault Diagnosis Using Unlabeled Data / ***Kuijin Zhou*** *(University of Electronic Science and Technology of China), Fengqiang Hu, Yuhui Peng, Luojie Shi, Zequn Wang*

Summary: This paper integrates dual convolutional autoencoders with distance-driven DBSCAN for fully unsupervised bearing fault diagnosis without labeled data.

18:30 Banquet

July 24 [Friday] Session D in Multifunctional Hall 5

16:30-18:00 **Failure Physics, Material Science, Data Analysis, and Reliability Testing**

Moderators: Peng Huang, Jiangxi University of Science and Technology, China
Ying Zeng, University of Electronic Science and Technology of China, China

16:30-16:45 QR2MSE2026-07-0007 Reliability Assessment of Plain Woven Cmc with Machined Square Holes via Full-Field Meso-Scale Modeling / ***Jinquan Deng*** *(Beihang University), Xi Liu, Dianyin Hu*

Summary: Establishing a full-field meso-scale framework, this study leverages an optimized Kriging surrogate model to highly efficiently assess failure probabilities and quantify geometric uncertainty in machined SiC/SiC ceramic matrix composites.

16:45-17:00 QR2MSE2026-07-0009 Thermal Reliability Challenges and Advancements in High-Power GaN Schottky Barrier Diode Limiters: A Comprehensive Review / ***Ke Li*** *(Xi'an University of Architecture and Technology), Kai Sun, Haihang Cui*

Summary: This paper reviews thermal reliability in high-power GaN limiters, covering thermal resistance, electro-thermal modeling, failure mechanisms, and management strategies.

17:00-17:15 QR2MSE2026-07-1003 A Dual-Correlated Hierarchical Multivariate Wiener process for Remaining Useful Life Prediction with Multiple Degradation characteristics / ***Zhiyuan Bu*** *(University of Electronic Science and Technology of China), Bing Long, Zhen Liu, Pengbin Yang, Xuemei Bai*

Summary: This paper proposes a dual-correlated hierarchical multivariate Wiener process that jointly models random-effect and driving-noise dependencies, providing a highly effective parameter estimation approach for accurate equipment remaining useful life prediction.

17:15-17:30 QR2MSE2026-07-1006 Failure Analysis of Adhesive Bonding Structures in Wind Turbine Blade Subcomponents under Coupled Bending-Torsion Loading / ***Dewang Li*** *(Lanzhou University of Technology), Li Yifan, He Jinyin, Zhang Chi, An Zongwen*

Summary: Using 3D finite elements with cohesive elements, this study shows coupled bending-torsion alters buckling and accelerates damage in composite blade adhesive joints.

17:30-17:45 QR2MSE2026-07-1012 Generalized Fiducial Inference for Asymptotic Anova and Simultaneous Confidence Intervals of the Gamma Distribution / ***Haoran Ji*** *(Hebei University of Economics and Business), Xiaoxia Shang, Liang Yan, Ze Shao, Xia Cai*

Summary: This paper develops a generalized fiducial inference approach to construct asymptotic ANOVA tests and simultaneous confidence intervals, providing robust statistical tools for the multiple comparison of gamma-distributed data.

17:45-18:00 QR2MSE2026-07-1023 Numerical Leakage Prediction for PEMFC Rubber Sealing Interfaces Based on MRT-LBM / ***Fankai Meng*** *(China Academy of Engineering Physics), Chaoyang Xie, Donghua Yue*

Summary: This paper develops a multiscale numerical workflow utilizing the multiple-relaxation-time lattice Boltzmann method to accurately predict gas rarefaction and micro-gap leakage behavior in proton exchange membrane fuel cell rubber seals.

18:30 Banquet

July 25 [Saturday] Session E in Multifunctional Hall 1

8:30-10:30 **Reliability, Maintainability, and Supportability**

Moderators: Kai Sun, Institute of Microelectronics of the Chinese Academy of Sciences, China
Junyu Guo, Southwest Petroleum University, China

08:30-08:45 QR2MSE2026-03-1007 UAV Path Planning for Emergency Monitoring Based on a Multi-Strategy Improved Ant Colony Algorithm / ***Kezhi Chen*** *(Chongqing University of Science and Technolog), Li L, Haonan Zhou, Hao Chen, Bodi Huang, Bin Liu*

Summary: A multi-strategy improved ant colony algorithm generates safe, energy-efficient, and smooth UAV flight paths for emergency monitoring in complex mountainous terrain.

08:45-09:00 QR2MSE2026-04-1030 Reliability-Economic Optimisation of High-Speed Train Wheelset Maintenance Using HASAC / ***Xinliang Dai*** *(University of Electronic Science and Technology of China), Hao Sui, Tudi Huan, Ying Zeng, Hong-Zhong Huang*

Summary: This paper applies HASAC-based multi-agent reinforcement learning to optimize high-speed train wheelset maintenance, balancing reliability, reprofiling decisions, and service-life extension.

09:00-09:15 QR2MSE2026-02-1001 Research on the Quality Supervision Mechanism of Shipbuilding Industrial Software / ***Bojiang Liu*** *(China Institute of Marine Technology and Economy), Lijin Wu, Xiaomei Shen, Weihua Zhan, Wei He*

Summary: Analyzing the pain points in China's shipbuilding software development, this paper constructs a systematic, five-dimensional quality supervision mechanism to ensure life-cycle control, standard adherence, and high-quality digital transformation of the maritime industry.

09:15-09:30 QR2MSE2026-02-0006 Federated Learning for Privacy Preserving Prediction of Ev Charging Duration Before Plug in / ***Yvxin He*** *(University of Electronic Science and Technology of China), Shiyuan Li, Zhongwei Deng, Chengruyi Deng, Hong-Zhong Huang*

Summary: A lightweight federated MLP predicts EV charging duration before plug-in while preserving privacy and handling heterogeneous client data without pooling raw records.

09:30-09:45 QR2MSE2026-02-1005 Numerical Simulation and Reliability Analysis of In-Hole Plugging for Fine Steam Injection in Heavy Oil Wells / ***Fulin Qiu*** *(China University of Petroleum-Beijing at Karamay), Xuliang Zhao, Zhichun Wang, Kai Wei, Shujie Zhao, Yazhou Liu, Qier Zhu*

Summary: To optimize selective steam injection operations, this study develops a coupled perforation-plugging numerical framework and Kriging surrogate models to efficiently evaluate system reliability and identify dominant variables causing plugging failure.

09:45-10:00 QR2MSE2026-03-0001 Optimal Maintenance Policy for a Series-Parallel Manufacturing System / ***Jiajia Ni*** *(Wenzhou University), Miaomiao Zheng, Fufen Xiong, Jiaxin Lin, Yifeng Chen*

Summary: This paper develops a Weibull-based maintenance decision model and Monte Carlo simulation approach to optimize preventive, opportunistic, and corrective maintenance policies for series-parallel manufacturing systems.

10:00-10:15 **QR2MSE2026-017-0006** Physics-Informed Structured Latent Learning for Multi-Modal Plasma State Inference IN Fusion Digitalization: a Tokamak Equilibrium Reconstruction Study / ***Zifei Xu****(Liverpool John Moores University), Musa Bashir, Zhongchi Liu, Jin Wang, Zaili Yang Yue*

Summary: This paper proposes a physics-informed latent ODE framework that fuses multi-modal tokamak diagnostics to improve reliable plasma equilibrium reconstruction for fusion digital twins.

10:15-10:30 **QR2MSE2026-01-1047** Thermal-Mechanical Reliability Evaluation of TSV 3D Integrated Devices / ***Haoqian Xu*** *(University of Electronic Science and Technology of China), Ying Zeng, Xiaofeng Yang, Ziyu Yan, Jing Li, Hong-Zhong Huang*

Summary: A thermomechanical reliability assessment combines FMECA, finite-element modeling, and fatigue/safety-margin analysis to identify silicon cracking as TSV devices' weakest reliability link.

10:30 Tea Break

July 25 [Saturday] Session E in Multifunctional Hall 2

8:30-10:15 **System Analysis, Simulation and Optimization**

Moderators: Yan Shi, City University of Hong Kong, China
Xiangyu Li, Taiyuan University of Technology, China

08:30-08:45 QR2MSE2026-03-1003 Disgn and Implementation of Capability-Assessment-And-Verification-Oriented Application Scenarios Modelling System for Informationized Equipment Software / ***Bojiang Liu*** *(China Institute of Marine Technology and Economy), Wei He, Ran Xia, Xiaomei Shen, Lijin Wu*
Summary: This research establishes a comprehensive application scenario modeling system covering entity deployment and external environments to realistically verify and assess the capabilities of information zed equipment software.

08:45-09:00 QR2MSE2026-03-0018 Prediction of Erosion Fields in Complex Industrial Piping Systems Using Cfd and Model Reduction Methods / ***Lijing Mu*** *(China Special Equipment Inspection & Research Institute), Xiaochen Tan, Yibo Ma, Zhengwu Qian, Shengxuan He, Cenfan Liu*
Summary: To tackle erosion-caused perforation of complex pipelines, this study proposes a POD-Kriging reduced-order model that accelerates simulations by three orders of magnitude with high-precision damage prediction..

09:00-09:15 QR2MSE2026-03-0026 Reliability Optimization of Bogie Frame Based on Ensemble of Surrogate Model / ***Zhiyang Zhang*** *(Dalian Jiaotong University), Zhenliang Fu, Dongxu Zhang, Wei Zhou, Kehan Li, Yonghua Li*
Summary: This paper presents a robust ensemble surrogate integrating optimized neural network, Kriging and polynomial response surfaces to boost high-speed EMU bogie frame reliability.

09:15-09:30 QR2MSE2026-03-0028 Physics-Guided Multi-Agent Reinforcement Learning for Fire Evacuation with Dynamic Topological Changes / ***Peihao Zhao*** *(South-Central Minzu University), Bo Yang, Meng Shi*
Summary: Overcoming static environment assumptions, this study proposes a physics-guided multi-agent reinforcement learning framework that dynamically integrates offline fire simulations to optimize evacuation routing during complex building fires.

09:30-09:45 QR2MSE2026-03-0012 Reliability Optimization of Biomass Lunch Box Pulping Process Based on Response Surface Methodology / ***Shengzhuo Liu*** *(Inner Mongolia University of Technology), Jianxin Wu, Yi Zhao*
Summary: This paper uses response surface methodology and Box-Behnken design to optimize straw biomass lunch box pulping parameters, boosting fiber dispersion, tensile strength and bearing capacity.

09:45-10:00 QR2MSE2026-03-1024 A Monte Carlo Approach to Survival Signatures for Natural Gas Storage Reliability / ***Yu Zhou*** *(Chongqing University of Science and Technology), Yichao Yin, Junfei Li, Yuanjian Yang*
Summary: This paper combines RBD modeling and Monte Carlo simulation to estimate survival signatures and identify critical components in underground natural gas storage systems.

10:00-10:15 QR2MSE2026-017-0002 Physics-Informed Gc-Gru for State-Of-Health Prediction of Lithium-Ion Battery / ***Lianqiang Yan*** *(University of Shanghai for Science and Technology), Minnan Yue, Wanyong Zhang, Chun Li, Wanfu Zhang, Zifei Xu*
Summary: A physics-informed GC-GRU integrates graph correlations, dual-scale degradation modeling, and uncertainty quantification for accurate lithium-ion battery SOH prediction.

10:30 Tea Break

July 25 [Saturday] Session E in Multifunctional Hall 3

8:30-10:30 **Fault Diagnosis, Prognosis, Condition Monitoring and PHM**

Moderators: Yixiang Huang, Shanghai Jiao Tong University, China
Zuoyi Chen, University of Electronic Science and Technology of China, China

08:30-08:45 QR2MSE2026-04-0012 Research on Fault Detection for Low- Frequency Acceleration Sensors of Spacecraft Structure Based on Statistical Invariants / ***Lei Wang*** *(Beijing Institute of Spacecraft System Engineering), Linling Li, Yunpeng Zhao, Liming Shi*

Summary: A statistical-invariant compatibility detection method corrects measurement deviations, improving low-frequency structural acceleration data accuracy for spacecraft.

08:45-09:00 QR2MSE2026-05-1004 A Fatigue Reliability Analysis Method for High-Speed Train Gearbox Based on Deep Gaussian Process and Active Learning / ***Feng Gao*** *(University of Electronic Science and Technology of China), Xinxi Yang, Huaming Qian, Chunfa Zhao, Xiangrui Lv*

Summary: Integrating a Deep Gaussian Process with a novel active learning function, this paper adaptively updates surrogate models to efficiently and accurately assess the fatigue reliability of high-speed train gearboxes.

09:00-09:15 QR2MSE2026-04-0037 A Time-Frequency Technique for The Analysis of Noise Contaminated Non-Stationary Signals / ***Mingteng Feng*** *(Qingdao University of Technology), Tianran Lin, Hongjun Wang*

Summary: This study uses subspace parameter estimation and iterative demodulation to extract concentrated fault ridges from noisy non-stationary signals.

09:15-09:30 QR2MSE2026-08-1015 Mission Reliability Assessment of Lunar Hopping Vehicle Propulsion Systems: A Dbn-Embedded Go-Flow Framework / ***Peijie Tan*** *(University of Electronic Science and Technology of China), Yixuan Zheng, Shiliang Wang, Xinghua Zhang, Yu Liu*

Summary: Combining GO-FLOW logic with a two-slice DBN, this framework quantifies cascading regulator-tank failures to assess lunar hopping vehicle mission reliability.

09:30-09:45 QR2MSE2026-04-1015 Torsional Vibration Analysis for Planetary Gearbox Fault Diagnosis: Mechanisms, Methodologies, and Perspectives / ***Xuanyu Liu*** *(Hunan University of Science and Technology), Xiaoli Tang, Yuandong Xu, Yuqiong Zhu*

Summary: This comprehensive review synthesizes torsional-vibration-based fault diagnosis methods for planetary gearboxes, categorizing signal domains, mapping dynamic fault mechanisms, and outlining future pathways for phase-domain and amplitude-phase fusion analysis.

09:45-10:00 QR2MSE2026-04-0025 A Physics-Guided Feature Decoupling Network for Bearing Fault Diagnosis / ***Zhen Xu*** *(Dalian Jiaotong University), Zhe Chen, Zhenliang Fu, Denglong Wang, Fan Yang, Yonghua Li*

Summary: This paper proposes a physics-guided feature decoupling network using speed-sequence masks for stable bearing diagnosis under variable-speed frequency drift.

10:00-10:15 QR2MSE2026-04-0043 Physics-Guided Residual Machine Learning for Gear Wear Monitoring Using Angular Transmission Error / ***Isyaku Muhammad*** *(Hubei University of Automotive Technology), Nana Boa Benfor, Aiqiang Zhang , Ted Andrew Eyram Tsike, Mustapha Muhammad*

Summary: A physics-guided residual learning framework estimates gear wear from tachometer/encoder-derived angular transmission error without auxiliary vibration sensors.

10:15-10:30 **QR2MSE2026-04-1039** An Intelligent Fault Knowledge Retrieval Framework for Electronic Components Based on Knowledge Graph and Deep Learning / ***Ying Zeng*** *(University of Electronic Science and Technology of China), Jing Li, Yuan Chen, Zhengxi Liu, Hong-Zhong Huang*

Summary: An intelligent knowledge-graph retrieval system combines Lattice-LSTM extraction, Neo4j, and NLP question answering to support electronic component reliability analysis and maintenance decisions.

10:30 Tea Break

July 25 [Saturday] Session E in Multifunctional Hall 4

8:30-10:15 **Reliability Modeling and Risk Analysis**

Moderators: Siyu Zhou, University of Electronic Science and Technology of China, China
Zhaochun Peng, Chaohu University, China

08:30-08:45 QR2MSE2026-08-1008 A State-dependent Patching Policy for Software Systems with Heterogeneous Vulnerabilities / ***Le Gao*** *(Tianjin University), Xiujie Zhao, Rui Peng, Zhen He, Shuguang He*

Summary: Formulating patching as a Markov decision process, this paper derives an optimal, damage-cost threshold policy that dynamically manages heterogeneous software vulnerabilities, significantly outperforming conventional time-based or number-based maintenance strategies.

08:45-09:00 QR2MSE2026-08-1005 Measure-Equivalent Physics-Informed Degradation Modeling for Cross-Condition Reliability Prediction with Fragmented Data / ***Zirong Wang*** *(Shanghai Jiao Tong University), Zhen Chen, Ershun Pan*

Summary: This framework uses Wasserstein measure-equivalent matching to calibrate interpretable stochastic degradation models for reliable multi-source fusion and long-term predictive maintenance.

09:00-09:15 QR2MSE2026-08-1010 Joint Maintenance Decision-Making for Heating Tiles in Thermoforming Equipment Considering Location Dependence / ***Qiannan Si*** *(Tianjin University), Shuguang He*

Summary: A discrete-time Markov decision process optimizes heating-tile replacement and spatial redistribution, balancing location-dependent wear and extending thermoforming equipment service life.

09:15-09:30 QR2MSE2026-01-0057 A Module-Preserving Preprocessing Strategy for Efficient Minimal Cut Set Computation in Fault Tree Analysis / ***Hanming Du*** *(China Institute of Atomic Energy), Xiaochen Xu, Wenjun Hu*

Summary: This paper proposes a decoupled preprocessing strategy for fault tree analysis that performs structural modularization prior to local simplification, optimizing both memory usage and computation time for minimal cut set determination.

09:30-09:45 QR2MSE2026-01-0055 Data-Adaptive Bounded Bayesian Fusion of Multi-Source Lifetime Data for Avionics Reliability Assessmen / ***Ziyi Wang*** *(Civil Aviation University of China), Xiaojun Yang, Xiangjun Dang, Limei Xie*

Summary: A data-adaptive bounded Bayesian fusion method weights heterogeneous auxiliary information to predict avionics equipment failure rates despite scarce lifetime data.

09:45-10:00 QR2MSE2026-06-0002 Preventive Maintenance Decision-Making for a Serial Cable Production System / ***Jiahang Chen*** *(Wenzhou University), Menglin Qin, Libo Zhou, Jinyang Le, Jianming Chen*

Summary: This paper models a three-equipment serial cable production system with buffers to optimize preventive and opportunistic maintenance using Weibull fitting and sensitivity analysis.

10:00-10:15 QR2MSE2026-06-0003 Maintenance Decision for a Serial Production System Considering Production Waiting / ***Shouqing Wang*** *(Wenzhou University), Chen Chen, Xiangqi Zheng, Jiantong Che, Mingyang Zhang*

Summary: This paper models production waiting in serial manufacturing systems, using gamma degradation and Monte Carlo optimization to balance preventive and corrective maintenance costs.

10:30 Tea Break

July 25 [Saturday] Session E in Multifunctional Hall 5

8:30-10:15 **Advanced Reliability and Safety Assessment of Marine and Offshore Structures**

Moderators: Yunling Ye, Wuhan University of Technology, China
Mengzhen Li, Wuhan University of Technology, China
Yiheng Zhang, Wuhan University of Technology, China
Ying Tang, Naval University of Engineering, China

08:30-08:45 QR2MSE2026-01-0033 Finite Element Simulation-Based Mechanical Performance Analysis and Experimental Validation of Anchor Cables in Wind Turbine Hybrid Towers / ***Xiaowei Yin*** *(Shenyang Institute of Engineering), Yujun Jiang*

Summary: This paper investigates the mechanical performance and fatigue response of hybrid wind turbine tower anchor cables under different wind loads using parametric modeling and ANSYS finite element analysis for structural safety.

08:45-09:00 QR2MSE2026-018-0002 Optimisation of Colour Configuration Strategies for Safety Signs in Shipbuilding Sites Based on Eye-Tracking / ***Xinyao Li*** *(Qingdao University of Technology), Chunyuan Wang, Guihua Yang*

Summary: Utilizing eye-tracking technology to optimize ship repair safety signs, this study proves that specific border, font, and background color combinations significantly improve visual effectiveness, fixation duration, and hazard recognition in complex environments.

09:00-09:15 QR2MSE2026-03-0010 Optimization of Wheat Straw Meal Box Pulping Process Based on Response Surface Methodology / ***Xiangdong Zhang*** *(Inner Mongolia University of Technology), Jianxin Wu, Yi Zhao*

Summary: To address plastic pollution, this study optimizes the pulping process for biodegradable wheat straw lunch boxes using response surface methodology, offering reliable guidance for sustainable industrial resource recovery.

09:15-09:30 QR2MSE2026-03-0035 Investigation of Evolution Characteristics and Onset-Time Prediction of Oil Boilover / ***Lin Zhao*** *(China University of Petroleum (East China)), Guiling Chen, Gongfu Zhao, Ruixiang Ding, Weibiao Zheng, Boyu Duan, Manqing Jin, Fachun Liang*

Summary: Utilizing a controlled small-scale heating platform, this study systematically investigates oil tank fire boilover mechanisms, establishing a highly accurate one-dimensional theoretical prediction model for early risk assessment.

09:30-09:45 QR2MSE2026-06-1008 Multi-Objective Optimization of Maintenance Intervals for EMU Multi-Level Maintenance Systems / ***Zhenliang Fu*** *(Dalian Jiaotong University), Qing Xia, Yonghua Li, Xiantao Zhang, Shaozuo Kuang*

Summary: Utilizing NSGA-II algorithms under defined reliability constraints, this paper optimally extends hierarchical preventive maintenance intervals for high-speed trains, significantly reducing scheduled sessions and lowering operational costs.

09:45-10:00 QR2MSE2026-01-0049 A Rule-Constrained Standard Compliance Verification Agent in Civil Aircraft Development / ***Songzhe Liu*** *(Northwestern Polytechnical University), Huarong Zhong, Zhiqiang Cai, Xingzhi Wang*

Summary: Demonstrating feasibility for safety-critical workflows, this paper proposes a rule-constrained agent LLM tool that decouples semantic understanding from deterministic Boolean logic evaluation to automate engineering standards compliance verification for civil aircraft.

10:00-10:15 QR2MSE2026-04-0047 A Lumped Mass Approach to Bearing Cage Wear and Skidding Fault Dynamics for Fully-Sealed Gate Valves / ***Yuesheng Wang*** *(University of Electronic Science and Technology of China), Renjia Wang, Tangfan Xiahou, Na Zhe, He Pan*

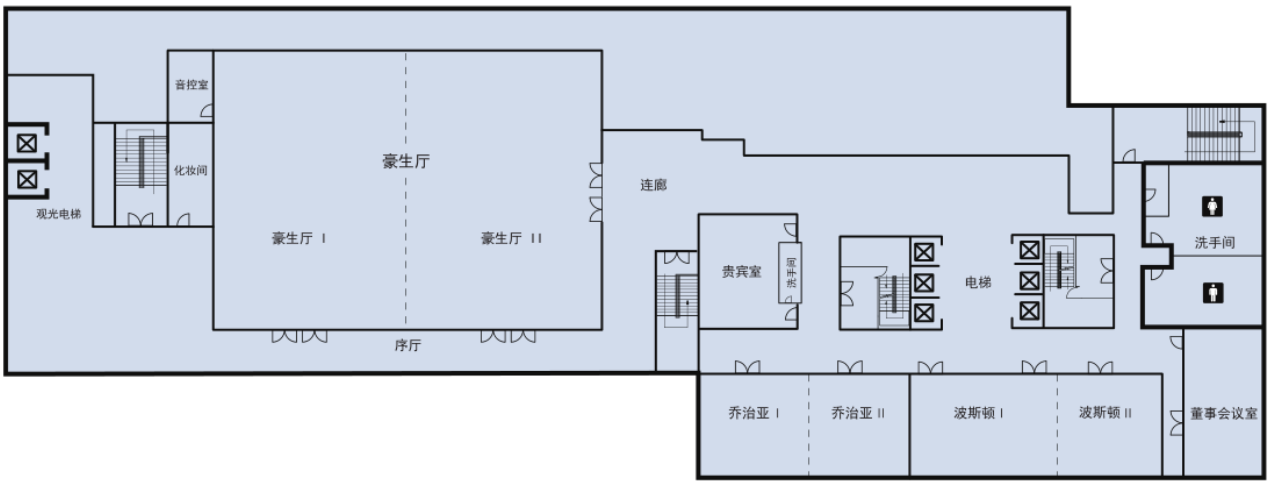
Summary: This paper combines a 4-DOF lumped-mass bearing model with EEMD-OMK signal processing to identify cage wear and skidding faults in fully sealed nuclear gate valves.

10:30 Tea Break

VII. Conference Information

A. Conference Venue (The 3rd Floor of HOWARD JOHNSON KANGDA PLAZA QINGDAO)

宴会厅平面图



The 3rd Floor of HOWARD JOHNSON KANGDA PLAZA QINGDAO

B. Registration

Role	Page Charges	Deadlines
Regular	500USD	On or Before May 31, 2026
Student	300USD	
Regular	650USD	June 1, 2026 – June 30, 2026
Student	450USD	
Regular	800USD	After July 1, 2026
Student	600USD	

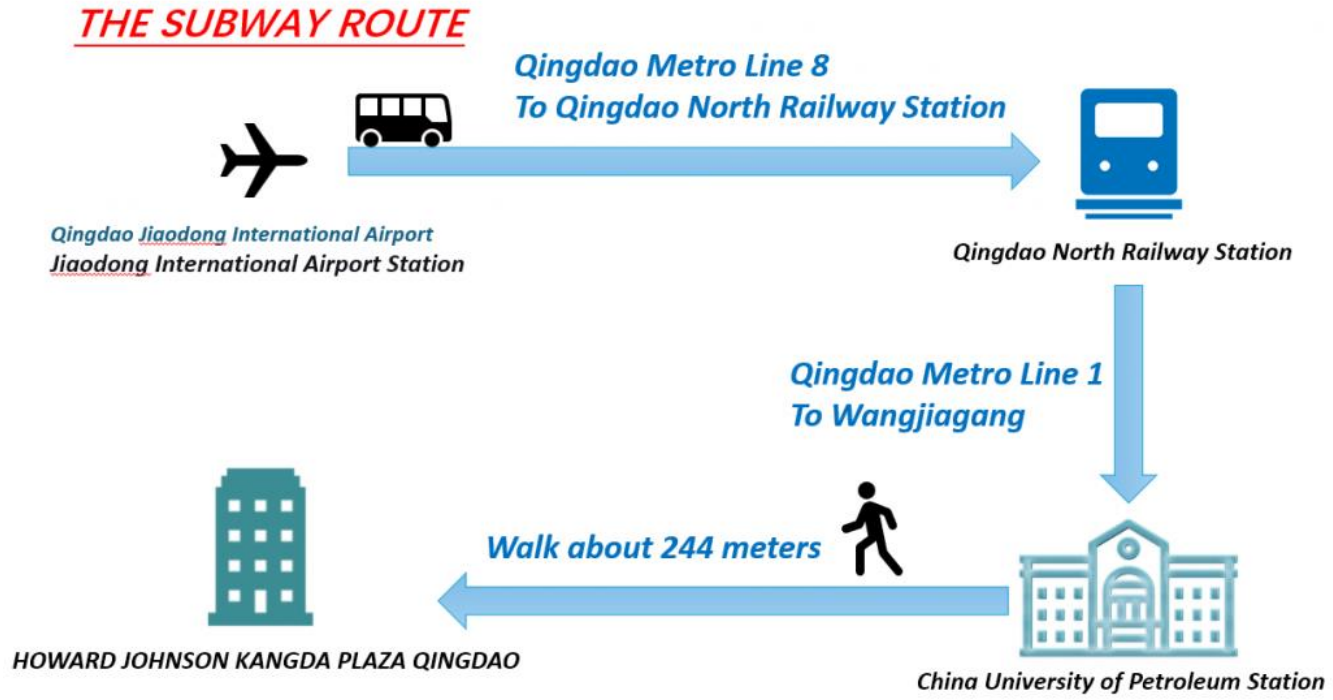
The regular registration fee includes all keynote speeches and technical sessions, lunch, the banquet, and souvenirs.

C. Transportation

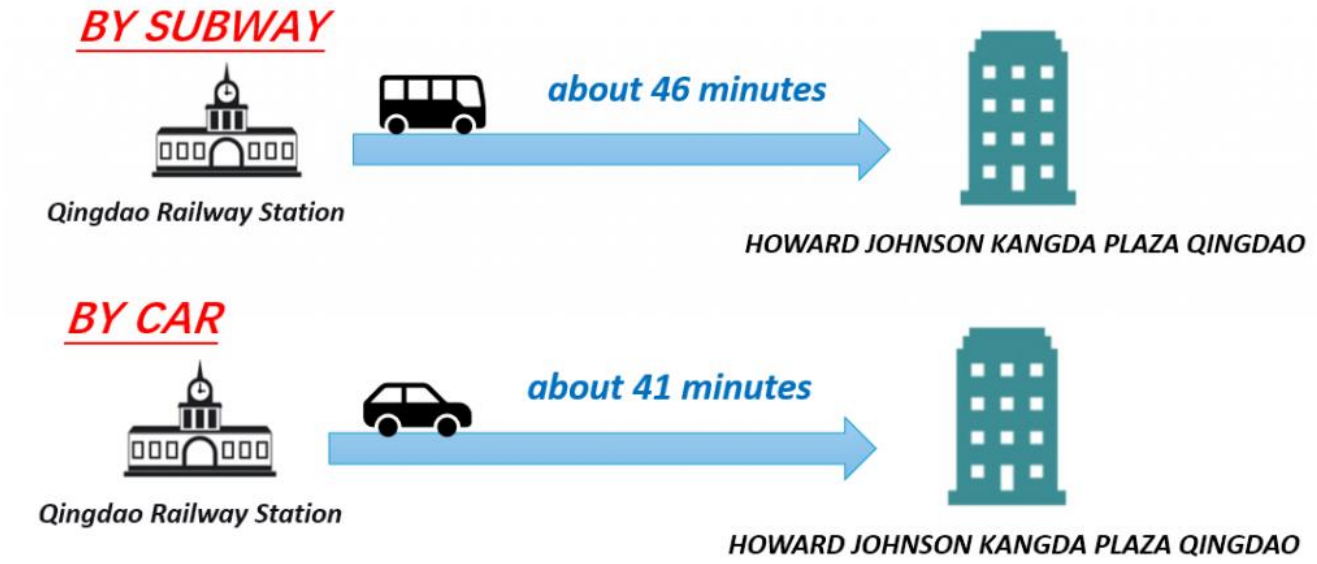
No. 159 Changjiang West Road, Huangdao District, Qingdao, Shandong, China

Access to HOWARD JOHNSON KANGDA PLAZA QINGDAO

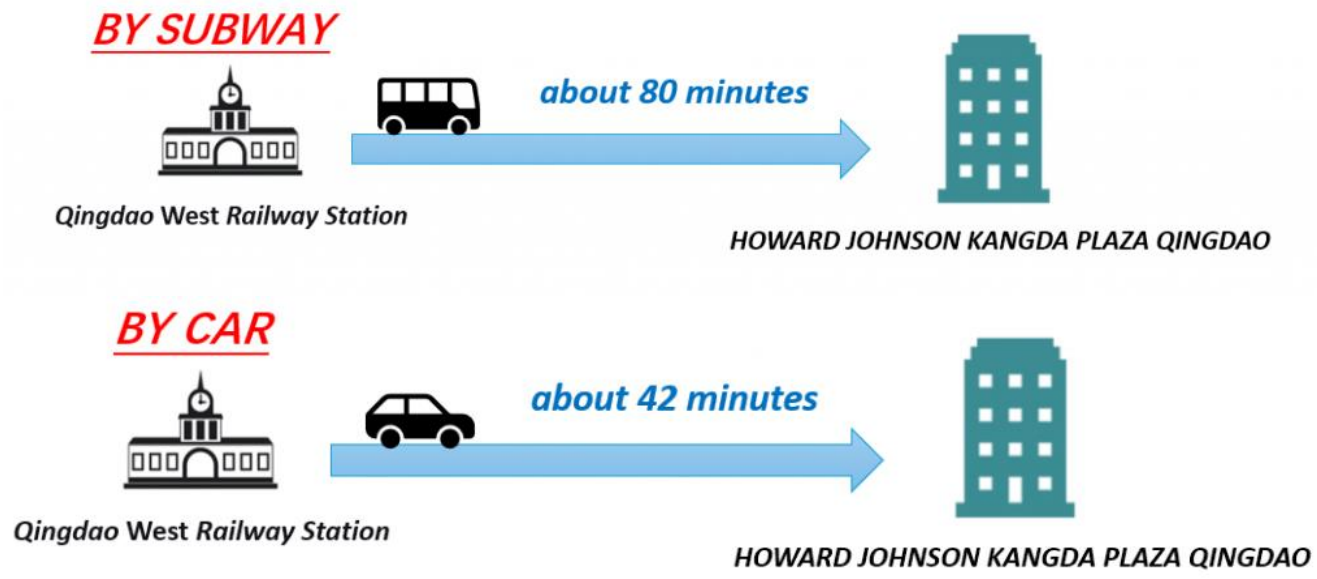
From Qingdao Jiaodong International Airport Route



From Qingdao Railway Station Route



From Qingdao West Railway Station Route



Contact information of conference secretariat

On-site helpers and volunteers at Qingdao Jiaodong International Airpor, Qingdao Railway Station and Qingdao West Railway Station are as follows.

Mr. Ding Ren	+86 177 1132 7582	Qingdao Jiaodong International Airport
Mr. Yi Ren	+86 155 4035 2588	Qingdao Railway Station
Mr. Hong-Fu Chen	+86 186 8312 6292	Qingdao West Railway Station

*** Please do contact the conference secretariat if you need any help with transportation.**

D. General Information

About Qingdao

Qingdao is a sub-provincial city and a planned city in Shandong Province, serving as the political, economic, and cultural center of the Shandong Peninsula. Located on the southern coast of the Shandong Peninsula, bordering the Yellow Sea in the east, it is the core city of the Shandong Peninsula Urban Agglomeration and a key node city connecting the Bohai Rim Economic Circle and the Yangtze River Delta Economic Belt. As an important coastal open city in China, it is a vital bridge linking the Eurasian Continental Bridge and the maritime Silk Road, and a core hub for international trade and marine economic cooperation in northern China.

Qingdao is a national historical and cultural city with a unique blend of Chinese and Western civilizations and a profound historical heritage. It is an important tourist distribution center integrating coastal scenery, mountain landscapes, colonial architecture, and Taoist culture; the ruins of Dabaodao Chinese Street, which witnessed the integration of Chinese and foreign cultures in the early 20th century; Laoshan Mountain, a famous Taoist mountain known as the “No.1 Mountain on the Sea”; and historical sites such as the Zhanqiao Pier, which symbolizes the city’s maritime culture. It also boasts numerous cultural landmarks including the Tsingtao Beer Museum and the May Fourth Square, making it a popular destination for tourists from home and abroad.

About Tourism

Laoshan Scenic Area

Laoshan Scenic Area is located on the eastern coast of Qingdao, adjacent to the Yellow Sea in the east and surrounded by mountains and seas. The reason for its fame lies in its unique geographical location, integrating steep mountains, clear waters, and coastal scenery. The scenic area features diverse landforms such as peaks, canyons, waterfalls, and coastal cliffs, which not only provide a magical natural environment for Taoist practice but also offer visitors a stunning visual experience of “mountains embracing the sea and the sea reflecting the mountains”. After exploring the mountain trails, tourists can relax by the coastal beaches, listen to the waves, and taste authentic local farm dishes. This contrast between mountain adventure and coastal leisure meets both the desire for exploration and the need for relaxation. Taking the sightseeing bus, visitors can enjoy the “Three Wonders of Laoshan”—the sunrise over Jufeng Peak, the sea of clouds, and the rime in winter—while passing through ancient Taoist temples such as Taiqing Palace and Shangqing Palace, feeling the harmony between nature and religion up close. It only takes about 30 minutes by car from the conference hotel to the scenic area.

The Zhanqiao Pier

As Qingdao's iconic landmark built in 1892, Zhanqiao Pier stretches 440 meters into Qingdao Bay, with the iconic Huilange Pavilion at its southern end—core of the "Flying Pavilion and Surging Waves" scenic spot, one of Qingdao's top ten scenes. Walking along the pier, visitors can enjoy the Yellow Sea's blue waves, distant Little Qingdao Island, and the old urban area's red tiles and green trees. In winter and spring, flocks of seagulls hover for interaction, while ebbing tides reveal beaches for shell collecting. Adjacent to Zhongshan Road and Qingdao Railway Station, it combines coastal scenery with urban charm. It takes about 15 minutes by car from the conference hotel to the scenic area.